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An Analysis of Electronic Data Processing Applications in Selected School Systems in Illinois

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AN ANALYSIS OF ELECTRONIC DATA PROCESSING APPLICATIONS IN SELECTED SCHOOL SYSTEMS IN ILLINOIS

by

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LIFE

Herbert Irwin Greenwald was born in Cleveland, Ohio on July 28, 1921. He graduated from Cass Technical High School in Detroit, Michigan in January, 1940. He received a Bachelor of Education degree from the Chicago State College in January of 1961 and a Master of Education degree from the same institution in December of 1962.

During World War II, Mr. Greenwald was engaged as an electronic technical writer, first for the United States Army Signal Corps and later for a private concern.

For a number of years he functioned as the manager of a window cleaning firm in Chicago, Illinois and also engaged in the practice of real estate and insurance sales.

He has taught science at the McPherson School in Chicago, as well as lecturing at Loyola, Chicago in Education and at the Chicago City College in Electronic Data Processing.

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CHAPTER I

INTRODUCTION TO THE STUDY

A. NATURE OF EDUCATIONAL INFORMATION

The nature of education requires that it always work with up-to-date information. This is true whether the concern is subject matter about which the teacher and the student are relating to a learning situation, whether the teacher plans the manner in which he can involve the student in order to fulfill the student's needs, or whether the administrator provides for the optimization of both of these areas.

Education long ago discarded the notion of doing things and making decisions predicated primarily on historical knowledge. It has come to realize that new problems require new and creative approaches. No longer are quasi-revelational decisions acceptable within the human community. The discharge of intellectual functions requires the ability to formulate new decisions predicated on current information.

This growing need for information has resulted in what one author terms an "information explosion." Information is being produced at such a rapid pace that the process of dissemination has become monumental. Certainly it has grown beyond the ability of the average professional to be able to keep up with his own field.

Fortunately, the information specialist and his technological counterpart have been busy finding ways to alleviate the burden. The most significant

approach in recent years has been the advent of the electronic, stored program computer commonly referred to as the Computer. This device has the ability to digest vast quantities of knowledge and almost instantaneously retrieve it for use.

This dual capacity has great merit, but it is only part of the story. Once inside the mechanism, the information can be modified and up-dated at the will of the user. These tasks are performed with a rapidity that is beyond belief, in addition to which their variety of application has only begun to be tapped.

The newness of electronic data processing in education requires the establishment of a body of knowledge concerning the state of the art. This development will allow the educator to make decisions based on his organization's needs rather than adjusting his requirements to the experiences of business and government. The task of this study is to contribute to this endeavor.

B. Definition of the Problem

This study will be concerned with determining the manner in which the electronic computer (EDP) can be used to its greatest effectiveness in the advancement of educational information services.

In the pursuit of this objective a number of questions will have to be answered. The following is representative of the kinds of questions it is hoped will be answered:

1. To what extent has EDP been of assistance in discharging the

responsibilities of administration, business, guidance and public relations?

2. What is the proper placement of the EDP administrator in the organizational chart?
3. Is it desirable that the EDP administrator have a professional background as an educator?
4. Should EDP equipment be purchased or rented?
5. Is in-service education for the school staff a worthwhile function?
6. What are the hiring and retention problems of the EDP administrator's staff?
7. Are cooperative arrangements among school districts of value?
8. What are worthwhile devices for communicating with the school and the EDP staff?
9. What is the value of "exception" reporting to school administration?
10. What simulation techniques and approaches appear to have value for educational planners?
11. Does the "total information" concept have value in education?
12. What of the future of EDP in educational information?

C. The Procedure

A number of approaches were required in order to adequately discharge this purpose:

1. A search was made of the literature in order to trace the history and growth of EDP and its predecessor devices. The nature of the enterprise will require that attention be paid not only to the usual library materials but also to current periodicals, newspapers and manufacturer's service literature.

2. Visits were made to educational EDP installations in Illinois in order to survey and describe the manner in which the different facilities are adapting EDP to aid them in the discharge of their responsibilities.

3. Interviews were conducted with EDP installation directors in order to elicit their opinions relating to the topics under consideration.

4. Interviews were conducted with EDP manufacturer's representatives which allowed insights into improvement of present-day usage as well as a determination of some of the future possibilities.

5. The summary and analysis of these findings led to the specific recommendations for the improved use of EDP.

D. Definition of Terms

ALGORITHM -- A precise and complete statement of a computational procedure.

BATCH OR BATCH PROCESSING -- The process of gathering together all like transactions for ease of processing.

BIT -- A character used to represent a portion of a binary number.

BYTE -- A computer word representation of eight characters.

COMPUTER ASSISTED INSTRUCTION (CAI)

CHARACTER -- The symbolic representation of a letter or a single digit number. It also refers to a computer's storage capacity.

COMMON BUSINESS ORIENTED LANGUAGE (COBOL) -- Used for programming computers for business applications.

CENTRAL PROCESSOR UNIT (CPU) -- The "Heart" of the computer.

CATHODE RAY TUBE (CRT) -- A visual display device.

DATA BASE -- A concept of economical data collection and storage.

DIRECT ACCESS -- A type of storage device, such as a disk pack, which makes data immediately available without searching serially through files.

DISK PACK -- A storage device consisting of rotating magnetizable disks that look like phonograph records.

ELECTRONIC DATA PROCESSING (EDP)

FORTRAN -- Formula Translation -- Used for programming computers for mathematical and scientific applications.

GENERATION -- Radical steps in the evolution of computer technology: vacuum tubes, transistors, microminiaturization, Large Scale Integration.

HARDWARE -- The various types of machinery that make up an EDP system.

INPUT-OUTPUT (I/O) -- Refers to the means by which information is fed and is retrieved into the computer for future use.

MARK SENSE -- A mechanical process to which a peripheral device is capable of responding.

MEMORY -- The core storage of the computer capable of containing information.

MULTI-PROGRAMMING -- The process whereby a computer is capable of performing two or more functions at one time.

NANO-SECOND -- One billionth part of a second.

ON-LINE -- An immediate access capability to the computer and its storage devices.

PERIPHERAL EQUIPMENT -- Devices operated by the computer.

PROGRAM -- The series of steps that the computer is to follow in order to perform a specific task.

RANDOM ACCESS -- A storage technique in which the time required to obtain information is independent of the information most recently obtained.

RECORD -- A group of related facts or fields of information treated as a unit.

REAL-TIME -- Use of a computer for immediate response in order to control an on-going situation.

SIMULATION -- Process of using a computer for emulating circumstances in the real world in order to elicit responses from which a human being will make a selection.

SOFTWARE -- The symbolic programs of instructions that direct the computer's functioning.

SOURCE DOCUMENT -- One that contains symbolic information that is to be introduced into a computer for processing.

STORED PROGRAM -- A series of instructions contained in computer memory that directs its functioning.

TELEPROCESSOR -- A remote terminal connecting a peripheral device to a computer by telephone line.

TIME-SHARING -- The process of two or more remote terminals using a computer simultaneously.

TIME-SLICE -- A computer's ability to record any number of functions being run simultaneously by giving each infinitesimally short bursts of time.

TOTAL INFORMATION -- A theory of computer usage in an organization whereby all information is interrelated in order to achieve a unified system and, hopefully, is immediately accessible.

CHAPTER II

HISTORY AND GROWTH OF ELECTRONIC DATA PROCESSING

Although electronic data processing is barely two decades old, its predecessor activities have their beginnings in antiquity.

Chapter II will trace the manner in which primitive man computed and recorded with less than rudimentary devices. It will look into a number of the various devices that have made contributions to the art and continue through the specific inventions upon which machine data processing and, eventually, electronic data processing are based.

A. Early History of Computing

The development of computing has a history that extends to primitive man. Some of the rudimentary methods used for calculating were, most probably, pebbles, notched sticks, or knotted ropes.[1] Records were kept by rock scratchings in these primitive times. This was accompanied by the use of fingers for counting. Rudimentary bookkeeping evolved from these simple procedures, heralding the advent of civilization and the necessity of record keeping.[2]

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[1] William H. Desmonde, (Computers and Their Uses, Englewood Cliffs, N.J.: Prentice-Hall Inc., 1964), p. 10.

[2] Elias M. Awad, (Automatic Data Processing, Englewood Cliffs, N.J.: Prentice-Hall Inc., 1966), p. 17.

Clay tablets of the Babylonian civilization of four thousand years ago indicates a system of records used by banks and loan firms. They kept records similar to modern procedures for different types of business transactions and recorded property tax ownership for state tax purposes.[3]

Papyrus or parchment was the medium used for recording receipts, disbursements, and special taxes paid to the ancient Egyptian government by its citizens. Early Greece and Rome kept their officials "honest" through systems of accounting for governmental transactions; the former used a clearing-house and the latter had a check writing system.[4]

The abacus, a device invented by both the Greeks and the Chinese, is still in prominent use by a large segment of the world's population.[5] Dating to 450 B.C., it is considered to be the world's first digital computer.[6] One writer, in describing the modern-day computer, refers to it as a "high speed abacus."

Henry I (1100-1135) established the first Exchequer system in England.[7]

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[3] Ibid., p. 18.

[4] Ibid.

[5] Desmonde, p. 10.

[6] Jeremy Bernstein, The Analytical Engine (New York: Random House, 1964), p. 26.

[7] The branch of the British government charged with the management of the public revenue.

The sheriff was responsible for collecting taxes which, in turn, were based on a volume termed the Domesday Book, containing a list of all taxable properties.[8]

Double-entry bookkeeping was started in 1494 by a monk, Venice Luca Paciolo. The good monk had written a book entitled Everything About Arithmetic, Geometry, and Proportion. In the last chapter he expounded his ideas concerned with bookkeeping.[9]

An ancient device, called a counting board and, operated on the same principle as the abacus, gave rise to a modern term, the counter. Its movable parts were called "counters." From this comes the display counter of today. The counting house, a little-used term today, also derived its name from this ancient device. The arithmetic terms "carry" and "borrow" owe their derivation to the manner in which the disks were manipulated on the counting board.[10]

The term stockholder has its origins in ancient banking. Loans were recorded by notching the amount on a stick. The stick was then cut lengthwise through the notches with each party retaining a matching half. The portion retained by the banker was termed the "stock."[11]

The first mechanical adding machine was the product of the mathematical genius, Blaise Pascal, who at the age of 16 also numbered among his accomplishments the invention of projective geometry. The device which Pascal formulated

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[8] Awad, p. 18.

[9] Ibid., p. 19.

[10] Desmonde, p. 11.

[11] Awad, p. 9.

was called the numerical wheel calculator. Pascal's father was the Superintendant of Taxes in Paris in 1642; it was a desire to help him that led Blaise to this project. His work in hydrodynamics served to establish it as a science, while his desire to assist a gambler friend resulted in a theory of probability that was the beginning of statistical science.[12]

In about 1600 a Scottish mathematician, John Napier, invented logarithms. From these he devised what were termed "Napier's bones" and what we now call the slide rule. The analog computer bases its problem solution on principles first propounded by Napier.[13]

The pursuit of knowledge of mechanical computing devices lay in the need to calculate scientific, function tables. One table, figured by hand, could represent the life's work of a single man.

In 1671 Leibnitz designed a combination adding and multiplying machine. The year 1694 saw his plans brought to fruition in a model but it would not function properly. He was later joined by Issac Newton in the development of the calculus.[14]

In the latter part of the nineteenth century a Frenchman, Joseph M. Jacquard, became interested in the problems of the French weaving industry.

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[12] D.S. Hallacy Jr., Computers - The Machines We Think With (New York: Harper and Co., 1962), p. 30.

[13] Ibid.

[14] Bernstein, p. 28.

One of the biggest of these was the difficulty of controlling the large number of needles required to create a pattern in the woven material; all of the known ways were very expensive. He concocted a scheme, which he patented in 1801, that diagrammed the desired design through holes in a card. Using the cards, one was able to control the needles to be actuated, and thereby saved many man-hours of work. This principle of card control later became vitally important in controlling automated bookkeeping systems and, subsequently, computers.[15]

As with many inventors and their brainchildren, Jacquard's contribution, initially, was little appreciated. In Lyons the city's fear of machines caused him to be attacked, and his machine destroyed. He was able to enlist the assistance of Napoleon in rebuilding the machine. It was generally acknowledged that Lyons' prosperity in the succeeding period was due to Jacquard's invention.[16]

An English mathematician, Charles Babbage, was engaged by the government to study the economics of the postal system. At his suggestion flat-rate charges were invoked. He contended that the prevailing system of figuring the proper charges for each separate destination was too expensive and too time consuming. The substitution of flat rate charges independent of the distance travelled led to many economies.[17] His was the first approach to the

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[15]Hallacy, p. 34.

[16]Awad, p. 22.

[17]Bernstein, p. 30.

actuarial theory. This was done for the Equitable Life Company.[18] Actuarial tables or "life tables" are the result of statistical analysis of large groups of people using various factors that may affect their life expectancy. Use of this approach is the only fair means of establishing different premiums for different individuals.

Babbage's spare time was spent in devising various mechanical means of simplifying the computational tasks involved in his work. In 1822 he completed his Difference Enging, an adding machine designed for the computation of polynomials.[19] The following year he conceived his Analytical Engine. This project occupied him for the remainder of his life.[20] He was, however, much too far ahead of his time because Metallurgical technology was far too primitive to allow the construction of a practical prototype. The Analytical Engine was a device designed to perform all arithmetic functions with the aid of separate machine functions. The four functions of his machine, which were not to be used again until modern times, were the following:[21]

"Store" - The part of the machine in which data relevant to the calculations under consideration were kept. This is equivalent in present day computers to a portion of the central processing unit (CPU), termed memory.

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[18] Ibid.

[19] Ibid., p. 34.

[20] Ibid., p. 36.

[21] Ibid.

"Mill" - The part of the machine in which arithmetic operations were carried out. In present day equipment this is termed the arithmetic register and again is an important part of the central processing unit.

Transfer - The automatic means by which data (numbers) are transferred back and forth between the mill and the store.

Input-Output - The mechanism that places the data in the machine and gets the new data out.

Babbage was far ahead of his time in other respects. He propounded the idea of "programming" his machine with the punched cards of Jacquard in order that its operation might be automatic.[22] And the conditional[23] statement of the modern computer occupied his thoughts long before there was hardware available to put it to use.[24] He referred to his sophisticated approach as, "Having the machine eat its own tail!"[25] The principle of "feedback,"[26] so important in electronics and automation, is based on this concept.

He worked on his Analytical Engine for nearly forty years but was never fated to see the success of his ideas. "Truly, the modern computer was Babbage's dream come true."[27]

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[22] Bernstein, p. 39.

[23] The ability of the computer to take alternate, procedural routes depending on the nature of prevailing conditions.

[24] Bernstein, p. 40.

[25] Hallacy, p. 36.

[26] Use of a portion of a device's output to control the input.

[27] Hallacy, p. 37.

B. Mechanical Calculators

In 1829 Charles Xavier Thomas of Colmar, France built the first working calculator. Utilizing Thomas's ideas, Frank Stephen Baldwin in 1872 inaugurated the calculating machine industry in this country.[28] These innovative machines were succeeded by the following:[29]

1887 - Dorr Eugene Felt patented his comptometer, one that is still widely used.

1889 - Felt marketed the first practical adding and listing (printing) machine.

1892 - W. S. Burroughs developed a 90-key machine with a capacity of nine decimal digits.

1914 - Oscar and David Sundstrand produced a 10-key adding machine. About this time the Monroe Calculator was invented by Jay R. Monroe and Frank S. Baldwin. This was a non-printing device but it could multiply and divide automatically at much greater speeds.

C. Ideas That Speeded EDP Development

At the same time that efforts were being expended in mechanical development, work was being done in the mathematics of symbolic logic. It was felt that certain patterns of human thinking could be reduced to two-dimensional diagrams. Leaders of this effort were Augustus De Morgan and George Boole. The former was interested in numerical, logical systems and the latter devised a new branch of mathematics termed, Boolean Algebra.[30]

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[28] Awad, p. 21.

[29] Ibid.

[30] Hallacy, p. 39.

Around 1869 William S. Jevans built what he called a "logical abacus" and a "logical piano," devices based on the principles of Boolean Algebra and which would supply answers by merely pressing the keys of the machine.[31]

1. Herman Hollerith and the Census

Federal statutes require that the census be taken every ten years. By 1887 an impasse seemed to have been reached; the 1880 census had required seven years to compile. This made it obvious that the 1890 census, or the 1900 at the latest, would be impossible to complete, "unless something were done to cut the birth rate or speed the counting."[32] Herman Hollerith was hired for the 1890 compilation and with a 62 million population he completed the task in one-third of the previous time.[33] This remarkable improvement was accomplished by fashioning a card machine predicated on the ideas of Jacquard and Babbage.[34] He later added electrical sensing to his machine, resulting in the first electrical computing machine.[35]

After completing his work for the government, he devoted his efforts to punched-card accounting. Companies which he later founded and merged with ultimately evolved into the International Business Machine Company (IBM). The IBM card, so familiar today, was the successor to what was then termed "Hollerith Coding."[36]

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[31] Ibid., p. 40.

[32] Ibid., p. 41.

[33] Ibid.

[34] Ibid.

[35] Ibid.

[36] Ibid., p. 42.

2. Early Electric Devices

A number of approaches seem to have played a minor part in molding present-day thinking and are listed here:

Range Keeper Mark I - Produced by the Ford Instrument Company in 1915 and thought to be the first analog computer.[37]

Short-Circuit Calculating Board - Built by the General Electric Company in 1920 to simulate real circuitry being tested.[38]

Electric Logic Machine - The first portable electric computer built in 1936 by Benjamin Burack, now a professor at Roosevelt University. This unit was able to test all syllogisms and was an extension of the ideas of Allan Marquand, who in 1885 had built a simple mechanical model but proposed an electric one.[39]

"A Symbolic Analysis of Relay and Switching Circuits." In 1938 Claude Shannon published this article in the Journal of the American Institute of Electrical Engineers. He was concerned with the logical bases upon which computers were programmed as opposed to the arithmetic concern. His ideas provided the basis for the design of present-day machines.[40]

3. Tabulating Equipment

A fairly large industry evolved around the use of electro-mechanical tabulating devices and the concept of punched cards. Much of the early approach to computer programming had been previously worked out in tabulating equipment, machines that could add, subtract, and print out lists of items and

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[37] Ibid.

[38] Ibid.

[39] Ibid., p. 44.

[40] Ibid.

their totals. Original information was fed into these machines in the form of punched cards. The information could be reused many times. Another important feature was the efficiency in punching new cards out with up-dated information on them.[41]

IBM 604 Tabulator -- This is a tabulator with the capability of performing 20 or more successive steps. These are governed by a stored-program previously fed into the machine through a plug-in type of board. A successor to this unit is the Card Programmed Calculator (CPC), which included the 604 mechanism but refined it by using a deck of cards to program the unit.[42]

Sorters and Collators -- These were developed to speed the handling of IBM cards. The former is used for putting large volumes of cards into an alphabetical or numerical sequence. Each card is divided into a number of "fields." Each field represents some aspect of information concerning the particular record represented by the card i.e., name, address, social security number, age, etc. By varying the setting of the sorting mechanism, it is possible to sort the cards on any basis desired.

The collator is a device that takes two or more decks of cards, that have relevance to one another, and merges them into a single deck.

The Key-punch -- Information, normally, is entered on punchcards in a serial manner, one letter or number at a time, through the use of a so-called

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41 Desmonde, p. 12.

42 Ibid.

The need for electronic computation began to make itself seriously felt during World War II. Weapons technology was being sharply accelerated, requiring higher speed computation than was available through electro-mechanical means.

At the Massachusetts Institute of Technology in about 1925, Dr. Vannevar Bush and his associates constructed a large scale, analog device. It was operated electrically and, except for this fact, was little improvement over the equipment of the past. In 1942 they completed a second model which the British found useful for the computation of artillery firing tables.[49]

Bush's devices were known as "differential analyzers." The General Electric Company used his system for such diverse purposes as part of gun-firing systems on B-29's and as the basis of a machine a hundred feet long. However, being analog devices they were merely extensions of the former mechanical approaches.[50]

In 1943 J. Presper Eckert and John Mauchly of the University of Pennsylvania began the planning and construction of the first electronic digital computer, the ENIAC.[51] The unit went into operation in 1946 and at the time it was characterized as the most complex electronic device in the world.[52] The ENIAC weighed thirty tons and consumed 150 kilowatts of electricity.[53] It had 18,000 tubes and 1,500 relays and could figure the

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[49]Bernstein, p. 50.

[50]Hallacy, p. 45.

[51]Electronic Numerical Integrator Calculator.

[52]Bernstein, p. 54.

[53]Hallacy, p. 46.

trajectory of a shell in thirty seconds, while a human being required twenty hours using a desk calculator. Although its greatest asset was its ability to do things that were not possible before,[54] nothing in the ENIAC was new technology, and had there been the demand, it could well have been produced ten years earlier.[55]

A problem of flexibility still existed in this developmental stage since a great deal of human intervention was required in the operation of the unit. Every new problem required a mechanical rearrangement of the board's circuitry.

John Von Neumann, a physicist, and inventor of "games theory,"[56] supplied the missing link in the conceptual pattern; he suggested the use of a stored program.[57] These views were originally enunciated in a paper entitled, "Preliminary Discussion of the Logical Design of an Electronic Computing Instrument." It shortly became a classic in its field. Basic to the stored-program concept is the idea that control of the instrument can be vested in the instrument itself. This leads to complete flexibility of operation.[58] It is Von Neumann's design of the MANIAC computer which is credited with our completion of the hydrogen bomb prior to the Russians'.[59]

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[54] Desmonde, p. 16.

[55] Bernstein, p. 56.

[56] The analysis of games in order to arrive at the best method of playing them.

[57] Desmonde, p. 17.

[58] Bernstein, p. 58.

[59] Hallacy, p. 156.

In light of the proven success of Von Neumann's ideas, computer technology proceeded at a highly accelerated pace, one that gives no indication of slowing down in the foreseeable future. Highlights of some of the outstanding contributions to the art follow:

1948 - Transistor developed by three scientists at the Bell Telephone Laboratories: J. Bardeen, W.H. Brittain, and W.H. Shockley who in 1956 received the Nobel prize in physics for their work.[60] The transistor is equivalent to vacuum tubes at a tiny fraction of the size, and they consume practically no power. The result was the miniaturization of computers, termed the second generation, followed by the micro-miniaturization of today or third generation.

1949 - EDSAC - Electronic Delay Storage Automatic Calculator operated in the University of Cambridge.[61]

1951 - SEAC - Bureau of Standards Eastern Automatic Computer placed in service in Washington in 1951.

1951 - UNIVAC I - Universal Automatic Computer. This is the first commercial stored-program computer, built by the Sperry-Rand Company for the Bureau of the Census.[62]

1954 - General Electric Company in Louisville, Kentucky received the first computer designed for business data processing.[63]

1954 - International Business Machine Company began work on Fortran language which by 1962 had undergone four revisions.[64]

1958 - The Defense Department in 1958 recognized the need for a business oriented computer language. COBOL was the result.[65] With the profusion of computer manufacturers arriving on the scene and the billions of dollars that the government would eventually have

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[60] Bernstein, p. 68.

[61] Ibid., p. 63.

[62] Ibid.

[63] Ibid., p. 81.

[64] Ibid., p. 72.

[65] Ibid., p. 76.

invested in computer hardware, it was important that programming software be compatible between manufacturers.

1964 - Control Data Corporation introduced third generation equipment based on micro-miniaturization of electronic circuits.

1967 - Department of Defense issued contracts to the University of Illinois and the Burroughs Corporation for development of fourth generation devices based on Large Scale Integration of electronic circuits in the order of 100 complete circuits on a surface one-tenth of an inch square. Probable activity will be in the range of one billion instructions per second.

The technology of EDP appears to have no limitation. Each new development spawns the germ of other ideas. Many knowledgeable people have expressed the opinion that EDP will eventually be the biggest business in this country and perhaps the world. At the time of this writing it gives every indication of fulfilling this promise.

CHAPTER III

NEED FOR ELECTRONIC DATA PROCESSING IN EDUCATION

Although the primary objective of this study is a determination of the manner in which EDP can be most effective in education, it is desirable that some consideration, initially be given to the need for it. It is the purpose of this chapter to supply some insights into this need.

The chapter begins with the use in industry by persons highly knowledgable about all aspects of the thesis, develops insights into the nature of Systems and Information Services, and concludes by examining specific areas of application.

A. General Considerations

In 1966 the president of the American Association of School Administration (AASA) appointed a Committee on Electronic Data Processing in order to explore "where data processing fits into the administrative hierarchy and the superintendent's role in EDP."[1] The Committee's report, EDP and the School Administrator, contains "some important guidelines and significant recommendations are made . . . which should have a profound impact on the course of the school administration in the years ahead."[2]

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[1]The Association of School Administrators, EDP and the School Administrator, (Washington, D.C.: AASA, 1967), p. VI.

[2]Ibid.

The AASA defines the need for EDP in education as follows:

> Responsibilities confronting the school administrator have multiplied in number and complexity. Traditional approaches in dealing with the demands of our time have been found wanting. The school administrator of today is beginning to look for assistance to the promise of a new administrative technology based in part on electronic data processing and the computer. Although the computer adds fuel to fire the forces of change, it can serve as a vehicle for coping with the very intricacies created. This powerful and sophisticated tool, just out of its teens, is beginning to affect the fabric of society, sparking amazement and apprehension. As an invention hailed as possessing more beneficial potential than any other in history, it is bound to have a profound effect on school administration as well.[3]

Educational approaches to EDP cannot be restricted to a narrow frame of reference. In the hands of creative persons this framework can be greatly expanded. "The American educational enterprise appears ripe for what computers can so uniquely do."[4]

The trend in too many instances has been to relegate the EDP function exclusively to a maintenance of the status quo rather than to use the equipment to evolve techniques that were previously impossible. Education must "break out of the lockstep, eggcrate program of today."[5] The present approach "constitutes a growing anachronism."[6]

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[3] Ibid., p. VII.

[4] John F. Goodlad et al., Computers and Information Systems in Education (New York: Harcourt, Brace and World, 1967), p. 10.

[5] Don D. Bushenell (ed.), The Automation of School Information Systems (NEA, 1964), p. 15.

[6] Goodlad, p. 20.

Well worth noting are some of what might be termed "way out" prognostications of EDP's influences on education:

> It offers more to the field of education than anything since the days of Gutenberg and his printing press.[7]

> Functional information systems can do much to make teaching the attractive and rewarding profession that it should be, and may provide the stimulus needed to retain those who are teaching now, and even bring back into the fold those who have become disenchanted.[8]

> ...as soon as we use the computer, in a sense life itself will change.[9]

> ...a radically new type of machine, not simply an extension of our limbs and our senses. It can be conceived in a sense as an appendage of our central nervous system.[10]

> ...school administration is destined to be changed radically by it. It is a source of hope to the administration confronted with many complex problems that thus far have defied solution.[11]

> In the past such traditional indicators as population, natural resources, gross national product, balance of payments, and military might have been used to measure national power. Now, however, economists discern a new yardstick: computer power.[12]

In exploring education's need for EDP it is worthwhile to look at some

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[7] Alvin Grossman and Robert L. Howe, Data Processing for Educators (Chicago: Educational Methods Inc., 1965), p. 5.

[8] Grossman and Howe, p. 4.

[9] Don D. Bushenell, The Computer in American Education (New York: John Wiley and Sons, 1967).

[10] Desmonde, p. 1.

[11] AASA, p. X.

[12] "Where the Brains Are," Newsweek, January 28, 1968, p. 57.

factors in education that influence its use. Goodlad sees three that are basically negative:

> Automation of any part of education appears to be somehow degrading and suspiciously dehumanizing.
>
> The realistic problem of maintaining modern educational programs on fairly constant incomes in relation to the number of pupils served.
>
> A serious lack of knowledge about the power and potential of computer systems for improving educational programs.[13]

Some positive factors that can promote the establishment of approaches to EDP in all educational systems are:

> Release of teachers from routine clerical and accounting duties.
>
> Public pressures for increased productivity, reduced costs, and greater efficiency in education in the space age.
>
> Need for improvement of curricula through analysis of data pertaining to pupil diagnosis in non-graded, team teaching, and similar developments.[14]

B. Information Systems

Accurate, up-to-date information is essential to the proper functioning of all human enterprise. From birth each man acquires bits and pieces of information through all of his senses, continually adding to this store of knowledge and impressions. Based on his own unique background, each person

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[13] Goodlad, p. 29.

[14] Ibid., p. 31.

makes a multitude of decisions. The mind processes the new information or data in terms of previous knowledge, often making adjustments on both. Human action is the result of this data processing activity.

Electronic information systems function in an essentially similar manner. They have a store of information, a means of processing it, and devices that can ingest it and then display it for action purposes. At this point the similarity ends. It is here that human wisdom takes over, "Wisdom and information are a powerful team. Computers can provide the information; educators must provide the wisdom."[15]

Just as the human brain is most accurate and efficient when all of its sensory apparatus is functioning properly, so an EDP system operates best when it has all pertinent knowledge available to it. In recent years this has led to the development of an important concept in data processing termed a "total" approach. In this approach:

> Questions are best considered from this total central standpoint rather than from the disparate viewpoints of the subparts of education: instruction, curriculum, guidance, research, and administration.[16]

It would appear that at least three important values would result from this method:

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[15] Ibid., p. 20.

[16] Grossman and Howe, p. 5.

> Essential financial, instructional, and pupil personnel records could be secured with a minimum expenditure of staff time.
>
> Maximum use of professional staff members time for professional purposes would be obtained by reducing to a bare minimum the amount of clerical work required of them.
>
> Data would be available at a time when it could be used most advantageously in helping students to attain their full potential; that is, as a basis for both guidance and instruction.[17]

James Gallagher, whose primary concern is business, sees an information system as having three basic elements, which are the:

> Use of data processing equipment involving computers and electronic input/output devices for the rapid collection, manipulation, and tabulation of data.
>
> Use of highly developed communications links between electronic computers and input/output devices so that one machine can talk to another or actually operate another, within the system.
>
> Proper selection and arrangement of information for planning and control so as to form a system of reports which will give . . . the key facts needed for decisions and underscoring especially the exceptions or abnormal situations needing his attention.[18]

C. Systems Approach

Preceding the establishment of, and a necessary concomitant to a total information service is a "systems approach" for the unification of all aspects

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17 Ibid., p. 6.

18 James D. Gallagher, Management Information System and the Computer (New York, American Management Association, 1961), p. 11.

of the educational establishment being considered. This process consists of "taking a total and systematic look at related operations and trying to find a unifying pattern as well as logical and efficient operating procedures."[19]

The design of a system is a creative work combining all of the latest technology into not only a new industrial revolution but also an organizational revolution.[20]

> A system is an array of resources designed and dedicated to achieve an objective according to some plan of action . . . includes, purposes procedures, people, machines, supplies, and other resources.[21]

D. Specific Areas of Application

An information service in education could be considered as consisting of four main areas, encompassing all aspects of the individual school, the district, or the regional data processing center:

1. General business accounting -- the financial and property accounting of all school business.

2. Student accounting -- the processing necessary to regulate and record student activities.

3. General administration -- the overall direction and control of students and employees according to policies, and practices specified by local, district, state, and national educational systems.

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[19] AASA, p. 2.

[20] Grossman, p. 8.

[21] AASA, p. 2.

4. Instructional programs -- the presentation to students of programmed curriculum materials and the rapid retrieval of documents and reports for instructional purposes.[22]

1. General Business Accounting

Generally, the introduction of EDP equipment in education is related to the need in the business area. This is not unique to education. Society's concern is too often related to keeping track of and conserving its financial resources. It has been found, however, that this is not an economical approach. Rarely is an EDP installation less costly than the electromechanical or hand system that it has replaced.

Areas of business applications are quite varied and often quite complicated. The beauty of the computer is the ease with which it can dispose of mundane business reports. Justification for the expenditure, and therefore the salvation of the tool, is the new and unique functions it can perform. It has more than fulfilled this promise.

Grossman and Howe[23] supply a list of specific types of accounts that are a necessary part of a school's business. They are the following:

Budgeting:

Purchase order
Purchase order register
Bid specifications
Encuberance document

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[22] Goodlad, p. 59.

[23] Grossman and Howe, pp. 40-41.

Purchasing:

Purchase order
Purchase order register
Bid specifications
Follow-up documents
Encumbrance document
Product and vendor statistical information

Payroll:

Payroll register
Salary checks
Earnings statements
Earnings record
Withholding tax reports
Retirement report
Reports for salary analysis

Supply Requsitions and Inventory:

Tabulations of requsitions
Adjustment of inventory records
Distribution of costs to schools and plants

Appropriation Accounting:

Warrant register
Expense warrants
Financial reports to schools and departments
Financial reports to the state
Appropriation ledger
Financial reports to board

Other Accounting and Record-Keeping Applications:

Cafeteria accounting
Cost accounting
Equipment records
Bus scheduling
Bus passes
Textbook inventory
Booking of visual and audio aids, research, and statistics

Personnel:

Personnel records
Qualification records
Job evaluation
Retirement status reports
Leave records
Teacher contracts
County notices of employment
Teacher assignments

Danger exists in the EDP technician's concern for business applications. The usual programmer and systems person has learned his craft in industry with the human frailty for doing things in the manner most comfortable to him, it

is possible that other applications will be neglected. "Present users very often confine practices to pedestrian or clerical tasks."[24]

It is indicated that a new breed of computer specialists must emerge; one which has a professional education background which gives it the insights into the needs of educators. "EDP is much too important to remain in the private domain of a narrow specialist who more likely than not will lack professional insights into education and its administration."[25] All indications point to the emergence of this approach.

2. Student Accounting

As each student progresses from the primary grades through the high school and college, a great deal of information is about him. In order that this information might be helpful and significant, it must be accurate, current, and convenient. EDP, properly used, is capable of fulfilling these requirements.

Specific kinds of information in the personnel record could be classified as follows:

Test scores
Family and home data
Attendance figures
Health status
Sociometric surveys
Grades and grade-point averages
Anecdotal records
School history[26]

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[24] AASA, p. 8.

[25] Ibid., p. 9.

[26] G.E. Pierce, Data Processing for Guidance and Counseling (Detroit: Automation Educ. Center, P.O. Box 2658, 1967), p. 3.

The quest for this variety of data has a number of bases, the primary one being a concern for the child as an individual. The more that is known about the child: his intellectual level, his environmental background, his physical condition, etc. the more he can receive.

EDP gives every indication of being of great assistance in fulfilling these needs by assisting the educator in performing a variety of functions. These include:

· Cutting down on clerical time[27] - Too much of an educator's time is devoted to a multitude of record-keeping functions. From the teacher in the classroom, whose instructional program is continually being interrupted for information, to the principal, who finds himself burdened with reports; educators are unable to perform primary teaching and supervisory functions. Subsequently, the profession has become overburdened with the ever-increasing complexity of records.

EDP in government and business has for a long time proved its value. Adequate dissemination of its potential will, most assuredly, do the same for education and, in truth, is beginning to make its presence felt.

Providing better evaluation of student abilities and educational goals[28] - In order that each student will be provided with the best education possible, there must be adequate means of evaluating his abilities, his potentials, and his interests. With this information easily and accurately accessible, he can

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[27] Ibid.

[28] Ibid.

then be directed to his greatest potential.

Human beings are incapable of performing some aspects of this function as well as machines; how long would it take for a group of humans to search an entire library and collate all documents relating to a particular subject? A computer could probably perform this same function 10,000 times faster. Just think of the value this would have to a guidance counselor trying to service 400 high school students.

Providing information for other schools and colleges[29] The process of articulation between schools at the same level, between elementary and high school, or between high school and college is often a difficult task. Properly utilized, EDP can bridge this gap in communications. For example, students transferring from one school to another often are handicapped through improper placement. Accurate and timely transfer of his records could well prevent this. Also, colleges require a great deal of information about each individual, information that, in many instances, is available in previous school records. If this is not readily available to the college, it might be a year or two before the information is collected. The student may no longer be in attendance when records finally arrive.

Planning and evaluating present and future programs in curricular development[30] Evaluative procedures in curricular development are a laborious and time-consuming procedure. On a relatively large scale feedback of results

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[29] Ibid.

[30] Ibid.

of new techniques lose their validity unless they are timely. With the aid of computers it is conceivable that, under usual circumstances, results can be expected to be almost instantaneous.

Simulation techniques, wherein a multitude of mathematical models of instruction and administration can be tested, present some of the most creative possibilities of EDP use in education. Simulation of systems operations makes it possible to pre-test the effect of a major decision without incurring the risk of making the decision in actual operations. The intent of simulation is to facilitate decision-making, not to replace the decision-maker with automatic formula management.[31]

The use of simulation as a learning device has untold possibilities:

> Working with the computer, a student can set up the conditions of any problem. For example, the operation of a department store for a year, or an astronaut flight to the moon, and then work out his own solutions. This process of simulation or gaming, some psychologists say, is the optimum mode of learning.[32]

3. General Administration

"Relatively little progress has been made in using EDP systems to improve general administrative practices in the schools."[33] Inherent in the task of

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[31] Gallagher, p. 41.

[32] The Challenge of Technology. Proceedings of a symposium. Institute for the Development of Education Activities (IDEA), Charles F. Kettering Foundation.

[33] Goodlad, p. 63.

creative administration is the initial planning and thoughtful analysis in approaching the task. The administrator must be able "to relate all . . . areas to a central point, that of the implications this modern technological revolution may have for the entire field of education."[34]

It is indicated that the weak link in the chain at the administrative level is in the area of reporting.[35] The need exists for a "carefully conceived system of reports to management."[36] The usual report consists of a simple enunciation of raw data with little relevance to actual needs.

> The superpower of the . . . equipment calls for a high echelon of administrative command and control center with the chief school executive at the helm, and a total commitment to EDP at all echelons of school administration.[37]

In its publication EDP and the School Administrator, the American Association of School Administrators proposes the following recommendations to its members concerning the proper utilization of the computer:

> One of the important professional talents for an administrator today is proficiency in the use and direction of electronic data processing and hardware.[38]

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[34] Grossman and Howe, p. 5.

[35] Gallagher, p. 12.

[36] Ibid., p. 13.

[37] AASA, p. 31.

[38] Ibid., p. 2.

. . . use of the systems approach for those desiring to introduce EDP in their school district.[39]

Each school district participate in, contribute to, or have access to an educational information system or a data bank related to its needs.[40]

. . . the superintendent, along with the other key school administrators be involved in a significant manner in the determination of needs and the design and operation of a school's EDP system.[41]

. . . the personnel requirements of every EDP system be given a high priority in planning by school administrators and that salaries for adequate numbers be budgeted.[42]

. . . drastic simplification of computer programming and greater compatibility among commercial computers would be highly desirable.[43]

. . . school systems give prime consideration to installing EDP systems based on third-generation equipment and not hardware made obsolete by new developments.[44]

. . . management, control, and evaluation of EDP be delegated to an administrative position qualified to serve the EDP needs of the school as a whole.[45]

. . . most school districts desirous of taking advantage of the potential that resides within third-generation computing power give serious consideration to entering into or establishing cooperative arrangements with other school districts or governmental agencies.[46]

. . . each state give serious consideration to the design of a wide educational information network which would connect local schools and the state education agency.[47]

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[39] Ibid.

[40] Ibid., p. 15.

[41] Ibid., p. 23.

[42] Ibid., p. 26.

[43] Ibid., p. 27.

[44] Ibid., p. 28.

[45] Ibid., p. 30.

[46] Ibid., p. 33.

[47] Ibid., p. 35.

> . . . all school plants be designed with the wiring, electric power, and space required for the operation of computers or at least computer input/output terminals connected to a central processing unit.[48]
>
> . . . all institutions of higher learning presently preparing school administrators develop adequately staffed programs and obtain access to computer hardware necessary for creating high skill levels among future and present school administrators in the comprehensive and use of computer systems.[49]
>
> School boards should provide opportunities for administrators to attend in-service seminars, conferences, or workshops dedicated to the promotion of EDP knowledge and skills.[50]
>
> Every state and local school operation should be part of some data processing system of a sophisticated nature either on its own or through some cooperative arrangement with other school districts in the area.[51]

4. Instructional Programs

A large, if not the largest, concern with computers in education is centered in the instructional process. Research proceeds at a merry clip in all subject matter areas and the journals report it extensively. It has acquired the readily identifiable nomenclature, CAI (computer assisted instruction). The nature of CAI places it outside the scope of this paper.

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[48] Ibid., p. 37.

[49] Ibid., p. 41.

[50] Ibid.

[51] Ibid.

CHAPTER IV

UNIQUE APPROACHES IN EDUCATION

Chapter VII in this study will examine in detail the operation of specific EDP installations. This Chapter seeks broader insights into the state-of-the art as reported in current periodicals and manufacturer's literature.

The reader is cautioned with respect to the ephemeral nature of what is written here; nothing in EDP remains the same for long. The dynamics of change are exponential and the person reading this volume in 1978 will, most certainly regard it as ancient history. In order to increase its relevance, this Chapter is organized around a number of broad categories: Total Information Service, Time-Sharing, Individualized Vocational Guidance, and Information Services.

A. Total Information Services

1. The California Research and Development Project[1]

In 1965 the United States Office of Education gave financial support to the California State Department of Education for purposes of establishing a total information service, including business, personnel, instruction, material and equipment, and pupil personnel.

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[1]Willard Goldstein, Annual Volume of Proceedings, (Association of School Business Officials of the United States and Canada, 2424 W. Lawrence Avenue, Chicago, Illinois, 1966), pp. 270-273.

The State Department, in turn, engaged the services of Aerojet-General Corporation to design the system and create the required software.

As established by the advisory committee and reported in the reference, the objectives include:[2]

1. The total system is to be designed for use by school districts. These objectives would be interwoven with the business operations of the county office.

2. An internal audit or validation process is to be included to insure that the input data meets processing criteria.

3. . . . adequate and sophisticated internal process controls.

4. Automatic entries for subsequent processing will be developed.

5. The maximum use of exception reporting will be utilized.

6. A standard package of cost analysis type reports will be developed.

7. . . . should include means for districts to forecast their financial situation for succeeding years.

A number of the interesting aspects of the tasks to be performed by the system are the following:[3]

1. In California a school district sometimes is required to keep two sets of books to meet its accounting obligations at both the state and federal levels. The proposed system will perform this task.

2. Payroll and personnel information will be combined.

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2 Ibid., p. 271.

3 Ibid., p. 272.

3. A complete purchase cycle from encumberance to payment of bill, to an update of the inventory will be inaugurated.

4. Concern for inventory with a minimum-maximum control and appropriate reporting will be included.

5. Complete property accounting will be initiated.

6. Simulation of future budgets will be possible.

In the 1967 Proceedings of the ASBO, Mr. Willard Goldstein reports that "the state effort has been temporarily suspended due to lack of funds. In the meantime, the Los Angeles County office is continuing its project to develop and maintain the various basic sub-systems, Financial Reporting, Payroll/Personnel, Accounts Payable and Inventory Control."[4]

Presently two of the sub-systems are operative: Financial Reporting and Inventory Control, while it is hoped to have Payroll/Personnel going by the fall of 1968.[5]

2. New England Educational Data Systems (NEEDS)

The New England states in 1960 formed a cooperative data processing organization termed the New England Educational Data Systems. Its purpose is "to explore applications of the computer to education and to develop working

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[4]The Los Angeles County School Business Management Information System, Annual Volume of Proceedings, (Chicago: ASBO, 1967), pp. 327-334.

[5]Letter from Willard Goldstein to Herbert Greenwald, February 15, 1968.

relationships among the key interest groups in New England education."[6] The sparsity of population of any one of the individual states embarking upon the development of its own system would probably have led to approaches inadequate to the necessary task.

The Project (NEEDS) was initiated by the New England School Development Council (NESDEC), an affiliation of the six state Departments of Education, the Harvard Graduate School of Education, and a large number of school systems in New England. By 1966, fifty-one school systems belonged to the organization and were receiving a full line of computer services.[7]

Membership in NEEDS is restricted to members of NESDEC. The cost is $300 per year for each school system plus $3.00 per capita for each high school student and $1.50 for each elementary pupil.[8]

The following is a capsule statement of the Project's objectives:

1. Modernize school information and record-keeping.
2. Improve school's data processing.
3. Assist administration in improving and refining its techniques.
4. Provide a bridging of the gap between university research and instruction in the schools.
5. Provide quick and accurate information access to state and Federal agencies.[9]

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[6] Report on the New England Education Data Systems, (Cambridge: NEEDS, 1966), p. 9.

[7] Ibid.

[8] Ibid., p. 12.

[9] Ibid., p. 9.

Each school system appoints a coordinator to the project. He assumes responsibility for all of the data management functions in his own organization and also is a link to the Project. His designated functions are:

1. Briefing his own people on EDP procedures.
2. Establishing schedules and seeing that they're observed.
3. Determining his own personnel's needs and ideas and conveying them to the project.[10]

The Project is structured to encompass four basic areas: Operations, In-Service Training, Operations Research and Systems Development, Basic Research and Formal Instruction.

Operations - This is the day-to-day and clerical aspect of running a school system. It includes every variety of record-keeping for each student, beginning with the establishment of a complete file and maintaining it as he progresses through the system.[11]

Attendance accounting is a function of the Operations section. This is comprehensive with monthly, bi-annual, and annual reports.[12]

Test Scoring and Analyses is another service of Operations. Eight different commercial tests can be scored and an analysis made for each student's

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[10] Ibid., p. 12.

[11] Ibid., p. 14.

[12] Ibid.

percentile in national and local norms. In addition the system can also process teacher-made tests.[13]

Grade reporting is an important function of NEEDS. Each system having its own unique format has a tendency to complicate this procedure. A recent development is an end-of-the-semester grade-point average on a weighted or unweighted basis.[14]

Of great assistance to all concerned is the function of scheduling support. If it is done manually, it is an overwhelming job, running into interminable lengths of time. The computer is ideally suited for this task, being able to consider the multitude of decisions that must be made in this procedure.[15]

In-Service Training - In this area NEEDS is mainly concerned with the education of the school system's coordinator. It is important that each coordinator understands what is available to his system and the services he can perform by bringing back to NEEDS any suggestions that can improve its service.[16]

Operations Research and Systems Development - This section is staffed by technical persons who translate education's needs into a workable system. It is working on a system of flexible scheduling that will represent improvements over the present methods.[17]

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13 Ibid., p. 15.

14 Ibid., p. 16.

15 Ibid.

16 Ibid., p. 25.

17 Ibid., p. 27.

Basic Research and Formal Instruction - An undertaking of this section is entitled, "An Information System for Vocational Decisions (ISVD)." The purpose of this project is that the student can relate knowledge about himself to data about education, training, and work, and can thereby create information on the basis of which he will be able to create information to make career decisions; it links student, computer, and counselor in such a way that the student conducts a dialogue with the computer, and the counselor assists in interpreting and evaluating the results.[18]

The NEEDS Data Bank is another extension of the research function. In it is stored vast amounts of educational data concerning the students. This data is available on short notice for any particular structuring function desired.[19]

B. Time Sharing

Small school systems need not be denied the benefits of high-priced EDP equipment. Many plans are available for the purpose of sharing hardware. Additionally, there are data processing centers which perform the more mundane functions. An appreciation of the probable expense of computerization can be gained from the appraisal, ". . . are beginning to approximate those of libraries and laboratories with no end in sight."[20]

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[18] Ibid., p. 30.

[19] Ibid., p. 31.

[20] G.E. Anderson Jr., "Look At How Colleges in Your Area Use Computers." (Nation's Schools 80: 98, October, 1967)

1. The Pillsbury Company[21]

In Minneapolis, Minnesota, the Pillsbury Company developed a time-shared service bureau type of operation. Theirs is unique in that it is not set up to perform the usual service bureau functions. Its purpose is problem-solving, any problem that can be expressed mathematically.

The system operates on an on-line basis with remote terminals in its subscriber's locations. On-line in this instance indicates that the remote location has direct and immediate access to the computer and, in turn, receives an immediate answer to its problem or question.

The program began as the result of the company installing a large computer system to replace four small systems. Rather than dispose of the original equipment, the company offered its use to educational institutions at a low rate.

Each subscriber can use his own programs and have them stored in the computer's memory. He can, when his quota of "memory" is filled, store additional programs on punched paper tape that he keeps on his own premises and, at such time as needed, feed it into the operating mechanism through his own remote terminal.

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[21] Business Education World, Volume XLVII, No. 10, June, 1967, pp. 3-4.

2. Massachusetts Institute of Technology[22]

The Massachusetts Institute of Technology has established an extensive time-sharing network of 160 remote terminals. Each has a direct access teletypewriter that enables the user to enter his message into the computer and receive a reply. The overall system is termed Compatible Time Sharing System and combines their Computation Center computer with what they term Project MAC (Multiple Access Computer).

Terminals are located in various laboratories and offices on campus; some are even located in the homes of research staff and faculty members. The system is also connected to the teletype network of the Bell System and Western Union so that access can be had from terminals all over the United States. The two computers have a simultaneous capacity of sixty users.

3. Regional Networks

The United States Office of Education is presently studying the feasibility of computer networks for schools on a regional network basis. Emil Anderson[23] poses specific questions and gives answers concerning the probable nature of the regional concept. The list of the answers follows:

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[22] R.M. Fano and F.J. Corbato, "Time Sharing on Computers," Scientific American, Volume CCXV, No. 3, September, 1966, pp. 129-140.

[23] G. Ernest Anderson Jr., "What Regional Computer Networks Mean to Schools," Nation's Schools, LXXX, No. 6, December, 1967, p. 56.

1. Lower cost and better quality service would result .

2. It could be used for instructional purposes at a number of terminals, a situation not possible with small units.

3. Such a system would enable the development of stronger evidence concerning the computer's effect on learning.

4. Problems that are encountered include the nature of facility control and the need to re-educate our teachers.

5. It would not be necessary to standardize administrative practices. Each school can use its own unique approach.

6. A region could be any size that may be desired.

The concensus among persons with vision foresees a "Data-processing utility" analagous to the present day public utility. Computer time will be purchasable in an individual's home or an organization's place of business merely by flipping a switch or plugging into a wall outlet. We have long possessed the physical technology required for this. What remains is the development of a need.

Alabama, California, Connecticut, Iowa, Michigan, and New York have commissioned their state Departments of Education to explore the possibility of setting up state-wide EDP systems.

> The computers will function in: retrieval of school data at high speeds on a state-wide basis; dissemination of technical information on a variety of educational subjects to all teachers, principals, and counselors; maintenance of detailed information on each student; making analyses and projections more quickly; and programming and scheduling for individual classes and students.[24]

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[24] Educational Researcher, 1967, Supplement, p. 6.

C. Individual Vocational Guidance

A good deal of effort is being expended to establish information services that will enable guidance people to render better service to their clients. This is a natural concomitant of education's continuing effort towards rendering the best possible service to every individual.

There is a paradox in this relationship between guidance and computers; it was just a short time ago that dire predictions were being made concerning the computer's elimination of large segments of the labor force. As has happened in technological revolutions of the past, this one so far has proven false.

William Cooley[25] was one of the first to enunciate a creative approach to guidance through the use of computers. He was concerned about the use of computers for jobs that are "exclusively a simple automation of clerical tasks previously done by hand."[26] Little need could be established unless the data was subject to query and interpretation. He saw the need to provide a "summary of . . . test score evidence with respect to particular questions, questions with educational and career relevance for each student."[27]

It was indicated that a desirable approach would be a system wherein students with difficulties could be easily identified.[28] To achieve this a

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[25] William W. Cooley, "A Computer Measurement System for Guidance," Harvard Educational Review, XXXIV, Fall, 1964, pp. 159-173.

[26] Ibid., p. 161.

[27] Ibid., p. 162.

[28] Ibid., p. 164.

great deal of data that relates itself to programmed experiences in a given setting will be required.[29]

1. Vocational Guidance at Penn State University[30]

The Department of Vocational Education at Penn State University is perfecting a computer based occupational information system to complement the work of counselors. Different kinds of audiovisual apparatus are used in order to effectively arouse interest: tape recordings with occupational information and interviews with persons in a given field, closed circuit television, color slides with an accompanying audio-taped commentary. The student interacts with the system through a remote computer terminal in whose memory has been stored the results of a previously administered General Aptitude Test battery.

2. Computerized Vocational Information Service (CVIS)

Willowbrook High School, Villa Park, Illinois is currently involved in a project "designed to use modern computer technology as a tool to do a better job of systematizing, retreiving, and applying a vast mass of information in meaningful ways for students and counselors."[31] Computer interaction for the

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[29] Ibid., p. 167.

[30] J.T. Impellitteri, "Computerized Occupational Information System," Vocational Guidance Quarterly, XV, June, 1967.

[31] Illinois Vocational Newsletter, Board of Vocational Education and Rehabilitation, Springfield, Illinois, December, 1967.

user occurs at a remote terminal containing a typewriter and a television screen.

The system stresses the avoidance of depersonalization and the fallibility of this type of presentation. Students voluntarily avail themselves of the service on a scheduled basis. Presently, two or three sessions are sufficient for an effective presentation.

D. Commercial Information Services

A number of commercial organizations as well as government agencies have created some innovative devices using EDP technology as their base. This section will discuss a number of those that seem to hold promise for educators.

1. Datrix[32] (Direct Access to Reference Info)

Researchers in the past could spend endless hours combing countless volumes searching dissertations for references to their particular area of interest. The computer has the capability of eliminating this endless task and channeling human effort in a more fruitful direction.

University Microfilms, a subsidiary of Xerox Corporation, has stored in its computer memory pertinent information concerning 95% of all recent

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[32] Key Word List, Xerox Corporation, Rochester, New York (A descriptive commercial brochure of Key Word Lists).

dissertations written in the United States and Canada. This information, in the form of key words, is derived from the titles, subject headings, and important descriptive words contained in the dissertations. For a five dollar fee the user can have an order processed and receive ten dissertation references. For each reference thereafter, the charge is ten cents. The subscriber is furnished with a printed list of the key words from which he selects those of interest to him. Three general categories are covered: Chemistry/Life Sciences; Engineering/Physical Sciences; Humanities/Social Sciences. If the researcher desires complete copies of specific dissertations, they are available in microfilm or Xeorographic form from University Microfilms.

2. ERIC (Educational Resources Information Center)[33]

In June of 1966 the United States Office of Education was instrumental in establishing a series of specialized information clearing houses. Each of these is concerned with a specific field: counseling and personnel, administration, exceptional children, etc., for a present-day total of eighteen units scattered throughout the country.

The system is divided into four major sections. The first is the management and coordination section in Washington, D.C.; second, are the clearing houses themselves; third, North American Aviation Corporation, Autometics

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[33]Lee G. Burchinal, "ERIC...and the Need to Know," NEA Journal, LVI, No. 2, February, 1967, pp. 65-72.

Division, which is in charge of computerization and production of a monthly abstract and a journal, Research in Education (RIE); and fourth, the ERIC Document Reproduction Service (EDRS), which sells copies of the reports cited in RIE.

The stated purpose of the service is:

> To provide a systematic and comprehensive link between (and among) researchers and the many potential users of research results, particularly teachers and administrators. In addition to abstracting and indexing the ERIC clearing houses perform two very valuable services to the educational community: (1) they respond to questions in their area of subject specialization which cannot be handled by the routine services of ERIC and (2) they prepare special publications, i.e., state-of-the-art or critical review papers -- as deemed desirable.[34]

3. Data Banks

The electronic computer is an ideal instrument for gathering vast quantities of data on a national or international basis and synthexizing it into a manageable form. The data bank is an outgrowth of this faculty.

The National Education Association[35] has three of them in operation: one is concerned with professional employees' negotiations; the second contains demographic and financial information; the third is concerned with school systems whose enrollment is 25,000 or more.

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[34] Educational Researcher, "A Description of ERIC," 1967 Supplement, p. 2.

[35] Ibid., p. 15.

Carnegie Human Resources Data Bank - In 1959-60 100,000 ninth grade Ontario, Canada students were studied by the Ontario Institute for Studies in Education. This information is now located at the Carnegie Human Resources Data Bank[36] with the data available to educational researchers.

Project TALENT Data Bank - What promises to be the most comprehensive research application in the social sciences is coming to fruition in Palo Alto, California. The resource consists of extensive data concerning a large number of students. Provisions for follow-up studies at intervals over a twenty year period is attributable to the availability of computers.

The Data Bank consists of the results of tests and inventories administered in 1960 to 400,000 students enrolled in grades nine through twelve in the United States. These results are concerned with their abilities, interests plans, activities, and background.[37] Further inquiry will be made of the same people at an interval of one, five, ten, and twenty years.[38]

The uniqueness of the project, making it of inestimable value to scientists include:

1. The longitudinal design.

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[36] Ibid.

[37] Lyle F. Schoenfeldt, "A National Data Resource for Behavioral, Social, and Educational Research. Palo Alto: American Institute for Research, 1968, p. 1.

[38] Ibid., p. 7.

2. The large and representative sample.
3. The breadth of both original and follow-up data.
4. The flexible method of data preservation.[39]

The Sample - Selection was made in a stratified random manner of all public senior high schools with their associated junior high schools and was based on the type of school, geographical area, size of senior class and retention ratio.[40]

The probability sample encompassed a total of 1,225 schools with a sample size of 400,000 students, which represented 4.5% of the target population.[41]

Two special samples were drawn: one is a "saturation sample" of all students in grades eight to twelve in the schools of Knox County, Tennessee; the second is a sample representing all fifteen year olds in the United States.[42]

The Data - Tests and inventories covered the student's knowledge of information, his aptitude and achievement, inventories of his interests and activities, and general information. Data also consisted of questionnaire results of one and five year follow-up inquiries, the nature of the school's characteristics, guidance programs, and counselors' attitudes.[43]

Use of the Data Bank - Qualified researchers can use this large mass of information in a variety of ways established by a policy committee of local

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[39] Ibid., p. 1.

[40] Ibid., p. 2.

[41] Ibid.

[42] Ibid., p. 3.

[43] Ibid., p. 4.

scientists: (1) The researcher can create the design and specify the particular analyses he desires, receiving from the computer a print-out of results. (2) The staff of TALENT does the design and prepares the report. (3) The tape, under unusual circumstances, can be loaned and stripped of all identifying information. (4) The original test materials can also be used in projects related to the original.[44]

The cost of these services are determined by the amount of computer and personnel time required to produce the desired work.[45]

For a variety of reasons, most of which are basically financial, education tends to lag behind business and government. EDP does hold a great deal of promise as has been indicated in this chapter, particularly in terms of data banks and information retrieval. As more educators are trained in EDP technology it is certain that a greater variety of uses will emerge.

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[44] Ibid., p. 13.

[45] Ibid., p. 14.

CHAPTER V

UNIQUE APPROACHES IN BUSINESS

American business has been in the forefront in developing EDP technology and in devising new and creative applications for its use. This Chapter will be concerned with a brief resume of some of the contributions that business is making.

In order that these applications be as current as possible, daily newspapers and frequently published periodicals were consulted as a major source of information.

The Chapter has four major divisions: Financial, Manufacturing, Health Services and a miscellaneous section termed Other Business Applications.

A. Financial Applications

1. Touch-Tone Card-Dialer Computer System[1]

The familiar plastic credit card has assumed a new function. The Beverly Bank of Chicago in conjunction with the Illinois Bell Telephone Company has devised an instant information service using the plastic card as the key identification device.

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[1] Chicago Sun-Times, "New Computers at Beverly Bank," February 7, 1968, p. 50.

Each customer has a card with his account number stamped on it. Inquiry to the computer is initiated by first inserting the bank card into a card-dialer telephone. The customer's card is then inserted to identify the appropriate account. When the specific nature of the inquiry is tapped out on the Touch-Tone using a pre-arranged code, the computer responds verbally with a recorded vocabulary of sixty-four words and numbers. The system can handle up to 300 calls per hour.

2. COMPAS (Computer Oriented Monthly Professional Accounting System)[2]

The Michigan Avenue National Bank of Chicago in 1967 inaugurated a unique bookkeeping assist for its customers.

> It provides a budgetary breakdown of all your checks issued during the previous month plus a year-to-date control . . .you can tell at a glance how much you spend for food, rent, mortgage, utilities, insurance, telephone, clothing, transportation, medical bills, entertainment, etc. . . at the end of the year you will have a complete record including tax deductible items . . . .

The blank checks furnished each customer are of a standard nature with a space at the top for the customer's code number. Each number from one through twenty refers to a previously identified expense category i.e., savings, mortgage, insurance, installment payments, mortgage payments, etc.

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[2] Advertising brochure of the Michigan Avenue National Bank, Chicago.

At the end of each month the subscriber receives a statement consisting of two separate sections. The first is the normal account breakdown of account debits, credits, and balances. The second part of the statement is the four column COMPAS breakdown:

"Description" - of the twenty specially designated items of expense.

"Amount This Month" - Total cash payout for the month in each expense area.

"Number of Checks" - Number of checks in each expense area for the month.

"Amount Year-to-Date" - Total accumulated amount for the year in each expense area.

In reality the COMPAS system is a simple extension of computer technology and has value limited to individuals and professional people with an expense categorization of twenty items or less. Small businesses would probably find little use for this system.

3. Lock-Box System[3]

A means has been found whereby large companies doing a nationwide business can keep up-to-the-minute on cash receipts from their customers around the country.

A number of years ago many of these companies set up regional post office lock-boxes, strategically located, in order that customer's receipts could be

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[3]Donald E. Johnson, "Bank Computers and Credit-Data Flow," Chicago Sun-Times, January 15, 1968, p. 65.

more quickly credited. This still required about three days for the creditor company to be notified by the bank handling the lock-box.

With the aid of a data transmission device operating over phone circuits, each of the fifty-one banks in the system supplies instantaneous information to its subscribers.

4. Electrofund (A checkless society)

A system of making payments without the attendant danger of carrying cash or the writing of a check appears imminent.

The plan of Electrofund has a number of extensions. One of these will be the immediate transfer of paychecks to banks through a computer network. Another aspect will be an ID card that allows purchases which will not be billed but, rather, will incur debits to bank accounts either immediately or on a charge basis as requested.

The savings in postage, human effort, and interest can be substantial. It would be a short step to provide the additional service as indicated in the "COMPAS" description. The developers also see a "terminal in every home with the added attraction of a television screen. This device will prove to be mother and father's little shopping helper and Junior's link to a teaching computer."[4]

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[4] Robert L. Kramer & W.L. Livingston, "Tomorrow: A Checkless Society," Chicago Daily News, January 13, 1968, pp. 3-4.

5. Federal Reserve Board

The Federal Reserve Board is replacing its fifteen year-old nationwide wire network used for transferring money, securities, and economic data. This large computerization task is scheduled to begin in November of 1969. This will not, however, be its initial computer effort; it had earlier converted its massive check-handling operation, 21,400,800 items for an $8.1 billion money value a day, into the new technology.

The initial capacity of the new approach will be ten to twelve times the present one, and data will be transmitted at a speed that rivals the teletype machine by about forty times. The board presently handles about 21,500 transactions a day with an average volume exceeding $26 million.[5]

6. Wall Street

Brokerage houses are finding ever-increasing uses for electronic computers. This is largely due to the accelerated level of stock trading by the American public.[6] The pace has become so great that it is difficult to keep up the attendant book work without a large number of costly errors. One approach in recent months has been the curtailment of trading hours on the New York Exchange; this has not been completely effective.

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[5] Chicago Sun-Times, February 28, 1968, p. 75.

[6] Clem Morgello, "Too Much for the Boys in the Back," Newsweek, February 5, 1968, p. 65.

A number of companies have seen the handwriting on the wall and are spending money to automate, "The Street is spending millions . . . ."[7] One company, Merrill, Lynch, Pierce, Fenner & Smith, has a system whereby "its computers can grind out the current status of every one of its margin accounts (82,000) in 1 1/4 hours, a job that used to take a sixty-man crew a whole night."[8]

The Exchange itself is working on the development of its all-inclusive system, Central Certificate Service, to keep track of all transactions handled by its brokers, thereby eliminating all physical handling. It has encountered a large number of difficulties but appears to be ready for tests by Spring 1968.[9]

B. Manufacturing

1. Ford Motor Company

The Ford Motor Company has been in the forefront of computer usage, particularly in the automotive industry. As early as 1960, Ford was using twenty-seven computers for "a complete system of profit controls for reaching into every nook and cranny of the corporation."[10] By July of 1966 133 computers

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[7] Ibid.

[8] Ibid.

[9] Ibid.

[10] The Detroit News, "Young Management, Computers, Mustang Give Ford Boost," July 6, 1966, p. 10b.

were in use and being staffed by 4,000 people in its EDP operations.

EDP has proved to be of inestimable value to the company. Ford, in comparison with General Motors, operates a well-centralized situation, and computerization lends itself well towards implementing their structure.

Systems analysis and mathematical simulation is used extensively for making decisions. Problems that formerly defied solution are now being solved. One future result of this promises to be the computerization of middle management and its eventual disappearance.

An example of Ford's success was its venture into the credit business. To do this, certain criteria were required in order to establish a rule book of lending policies. Fifty-two factors were programmed into a computer and related to one another in order to arrive at a basis of determination.

The Mustang automobile, a great success at the time of its introduction, and a leader in the field today, was a result of Ford's ability to design, market-research, and mass produce this innovation in the motor car field. Chevrolet took almost two years to respond with its Camaro.

2. Westinghouse Electric Company

Westinghouse, one of the oldest electrical and electronic manufacturers in the world, has made important contributions to the electronic art and has been in the forefront of computer utilization.

Management information of a current nature is essential in their business. Their continuing consideration is "to shrink the lead time in the management

information cycle to practically nothing, and eventually to be able to prepare a final report that will include just about everything top management needs to make its decisions."[11]

Of additional consideration is the need to sift out non-essential information not requiring a top management decision. This is a process termed "exception" reporting-getting to the essence of situations that require attention or human intervention:

> Costs in a certain plant have been normal for a while, but begin to rise steeply. Without the computer, these costs would get far out of line before being noticed, and would not be brought back for a week or more; but with real-time control they get only a little out of line before being noticed, and are brought back promptly. The cumulative effects on profits can be enormous.[12]

In the late 1950's the company went into inventory control, an important profit endeavor in a company this large. "Inventories . . . had a habit of piling up unless demand was estimated correctly."[13] Simulation techniques were instituted in order to take into account all of the factors concerned with customers' purchasing habits. The result was an accurate forecasting of these needs and a subsequent improvement of customer service and stockholder profit.

Their Tele-Computer Center is a vast network linking 360 offices,

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[11]Gilbert Burck, The Computer Age, (New York: Harper & Row, 1965), p. 35.

[12]Ibid., p. 36.

[13]Ibid.

factories, and warehouses, handling all transactions in an optimum fashion. The company as a result has closed six of their twenty-six warehouses and has been able to cut inventories by 35% while at the same time providing better service.[14]

Simulation is also used for studying other operations: work scheduling, evaluation of plant sites, investment appraisal.[15]

3. Lockheed's System ADA

Automatic Data Acquisition (ADA) is the manner in which the Lockheed Company approaches computer technology.

> . . . every part or piece of machinery arriving at the plant is immediately inventoried in the computer's memory, and from then until it leaves the plant its movements are recorded . . . . The computer always knows where the piece is, who is working on it, and what the job costs in wages.[16]

The system cost $2.3 million to develop and in 1964 was returning a total of $2 million in savings a year. This substantial return on investment resulted in the elimination of 400 expeditors and clerks whose job had been that of keeping track of inventory supplies.

Other benefits that Lockheed enjoyed as the result of the development of ADA were:

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[14] Ibid., p. 37.

[15] Ibid., p. 38.

[16] Ibid., p. 40.

1. Its work scheduling was optimized.
2. Employee morale was improved through more direct employee contact with management.
3. Work could be located instantly.
4. Manpower and plant needs could be forecast.
5. Inventories were kept at optimum levels and costs.
6. Top management was relieved of a great deal of detail.
7. It resulted in the basis of an integrated management control system.[17]

C. Health Sciences

1. Heart Diagnosis

A leading heart specialist, Cesar A. Caceras, with the aid of a staff of sixty doctors, electronic engineers, and technicians is making use of electronics technology in his research for a solution to the problems of heart disease.

The program, sponsored by the U.S. Public Health Service, is designated as the Instrumentation Field Station, Heart Disease Control Program. Though located in Washington, D.C., it is hooked up to a number of other hospitals and government clinics throughout the area for the purpose of receiving their medical signals over leased wires. The Program applies the principles of data processing to the analysis of electrical pulsations generated by the human body. Though presently concerned with the heart, it is hoped that these techniques soon will be extended to the other body organs.

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[17] Ibid., p. 41.

> A key objective of our program is to develop a prototype system for electro-medical signal analysis which can be adapted by private groups of hospitals, clinics, nursing homes and doctors within their own service areas. The system is designed to decrease observer error and variation, to reduce medical costs, and to conserve the time of physicians for direct medical care.[18]

The Program has evolved a distinctly new approach, using old techniques for recording purposes. The unit consists of a tape recorder mechanism combined with an EKG machine. Information can either be stored for later batch transmission or transmitted directly to the computer.[19]

The computer is programmed to analyze the data in the same way that an electrocardiographer would do it and then print out an interpretation of the results with information identifying the source. At the same time that information is printed out, a paper tape is being punched out duplicating the results. This paper tape is then transmitted back to the sending hospital where it is interpreted into plain language on appropriate equipment.[20]

Interpretation error has been reduced to 1% through the use of this approach. This is considerably less than has been possible by human interpretation.[21]

Future developments are towards a further refinement of the approach in the following manner:

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[18] The Office, "Computers Join the Fight Against Heart Disease," Volume LXVI, No. 2, August, 1967, pp. 43-44; 95-97.

[19] Ibid., p. 95.

[20] Ibid., p. 97.

[21] Ibid.

1. Electrocardiogram data pools for the accumulation and dissemination of scientific information . . . allows comparability of electrocardiograms processed under standardized conditions.

2. Extensive processing of EKG and other tests will be handled on an on-line real-time basis.

3. EKG of every patient entering a hospital will be analyzed as a routine procedure.

2. A Hospital's Total Information Services

The Downstate Medical Center of New York University uses three computers to provide its 350-bed teaching hospital (800 students) with a "total" information service.

One of the computers is an analog device used for medical research, while the other two are tied together in a teleprocessing and communications network termed THOMIS (Total Hospital Information System). The EDP staff consists of fifty-nine persons with a payroll of $400,000 per year and an equipment rental cost of $20,000 per month.[22]

Input terminals to the system are strategically located in such places as admitting areas, nursing stations, laboratories, clinics, business offices etc. This allows for complete control of costs i.e., "a terminal in the pharmacy enters orders as they are received and brings the inventory up to date. If required, a cost analysis program is provided."

All auxiliary services that a doctor might prescribe, such as laboratory

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[22] D.S. Johnson, "Total Information - Total Control at New York Downstate's Data Center," The Office, Volume LXVI, No. 2, August, 1967, pp. 35-38.

tests and electroencephalograms, are entered into the computer by the ward clerk. If the test is for the same day the wheels are set in motion in order to facilitate the procedure; if for a future date the order is handled on the night run of the computer.[23]

Every service rendered to a patient is transmitted to his account stored in the computer memory. When his discharge is ordered a statement of charges is printed-out on peripheral equipment, and his bed availability is adjusted.[24]

The hospital's system is also the center of a community system entitled EMBERS (Emergency Bed Request System) -- a network of nine member hospitals used for dividing the pediatric load among them. Reporting of the EMBERS consists of directing the patient to the proper hospital and informing the hospital concerning the patient's arrival.[25]

A library retrieval system is available for medical students. Keying in the reference area concerned, elicits all of the references available.

Other areas in which the system performs are:

1. Medical school's business office.
2. Personnel departments of both school and hospital.
3. Hospital public relations department.
4. Faculty and staff records.
5. Admission applications for the school.
6. Purchasing control etc.[26]

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[23] Ibid., p. 35.

[24] Ibid., p. 36.

[25] Ibid., p. 37.

[26] Ibid., p. 38.

D. Other Business Applications

1. Operations Research

A new type of consulting firm is making itself felt in business, consisting of professional scientists, mathematicians, physicists, engineers, etc. Their concern, termed Operations Research, consists of analyzing the nature of their client's businesses and determining how they can become more profitable.

The Caywood-Schiller Company of Chicago has been engaged in this pursuit for fifteen years. Their staff consists of thirty-five professionals working on problems such as that of a feed company which was making a decision about buying or renting railroad cars. A computer program was written for them simulating the purchase of varying numbers of cars and running them on probable journeys around the country in order to determine the most economical approach.[27]

A loan company with 1,800 branch offices needed a simple approach to granting loans rather than the customary credit check. Caywood-Schiller figured out a numerical point system which was based on the application itself and saved 100,000 credit checks a year at $3.00 each.

Life is often complicated in the research business. The analysis of wheat shipments to Russia in 1964 couldn't possibly foresee the extenuating

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[27] Donald M. Schwartz, "Schiller Researches a Path to Success," Chicago Sun-Times, February 15, 1968, p. 46.

circumstances that would confront their client.

> Almost immediately things began to go to hell. American longshoremen staged a walkout demanding the wheat go only in U.S. flag vessels and with U.S. crews, information on some rail cars of wheat was insufficient to plan the mixing by computer; the whole operation, with its many untidy changes in conditions, was far off the mark of scientific management.[28]

2. SABRE (Systematic Airline Business Reservation Environment)

The American Airlines, a pace-setter in the use of computer technology, has invested over $30 million in their sophisticated real-time installation, SABRE. Initially, its function is that of a seat reservation system with built-in capability of branching into a complete information control system for their airline.

It takes 2 1/2 seconds for a passenger to be booked for as far as a year ahead. This also involves keeping track of his meals, his car rental, or his connecting reservation.

The system has resulted in savings of about 30% a year on American's computer investment, largely due to the instantaneous knowledge they now have of passenger load, enabling each flight to show a profit rather than a loss.[29]

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[28] Ibid.

[29] Gilbert Burck, p. 34.

3. A Small Business User

An optics research firm has found the computer to be of inestimable value in its work.

The John R. Miles Corporation of Elk Grove Village, Illinois, a small firm of ten people found that with a computer it could replace fourteen girls working at fourteen separate calculators.

> Critical in the company's work is checking the refraction of light through a lens system. A perfect lens would bend the light striking its curved surface and focus it all at one point beyond the lens. A computer can be programmed to trace the path of the light rays, thus aiding the engineer in the design of the lens and in correcting the lens.[30]

On some days as many as 50 million calculators are required. One pre-computer job for the Navy that took two years can now be done in two weeks.

An important innovation in the company's work has been the release of its rented unit, whose cost ran between $3,000 and $4,000 a month and replacing it with a time-shared device located in downtown Chicago. The rented time costs $350 a month for a minimum of 25 hours; all time over this is billed at the rate of $10 per hour. The rented computer is owned by the General Electric Information Processing Center and is available for rental by as many as forty customers, each of whom is connected to it by a telephone line.

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[30] Edwin Darby, "Reducing Computer Costs," Chicago Sun-Times, May 25, 1966, p. 65.

4. Computer Software

"The care and feeding of computers seems destined in time to become the more profitable part of the electronic data processing game."[31]

One might draw an analogy between human beings and a computer by comparing the software to the human brain and hardware to the remainder of the human body. As has been indicated earlier in this paper, the computer is worthless without human intelligence to direct it. This direction is carried out through its software components.

All indications point to a decelerated rate of hardware improvement and increased concern for full implementation of its capabilities. To this end, ever-increasing amounts of money are being invested in programming and programs. On a dollars and cents basis, an independent survey foresees software as a $7 billion a year industry by 1979, with hardware at that time approaching $7.2 billion. This contrasts with a 1965 volume of $1 billion for the former and $4.5 billion for the latter.[32]

Computer Sciences Corporation, a firm originally engaged in hardware manufacture, is now doing a $39 million software business. It contracts with large manufacturers and the government to supply them with a number of their programming needs. Computer Sciences Corporation's business, presently, is

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[31] James Byrne, "Computer Sciences Corporation Setting Software Pace," Chicago Sun-Times, June 11, 1967, p. 101.

[32] Ibid.

about one-half government oriented. A recent concern involved the development of a government system for the space effort, while another termed "Computicket" will bring the sports or theater box office as near as the neighborhood bank or shopping center.[33]

Recently announced by the General Electric Company is a "data processing system to give low-cost inventory control and a 'first step' towards a total manufacturing and control system."[34] This will be available to all companies renting their 600 series of machines and represents a "part of the new trend in industry to provide the businessman with new uses for the machines he already has or wants to buy."[35]

5. Computer Fallibility

Lest one get the impression that this marvelous machine is the be-all to end-all, one must be cautioned concerning its fallibility; it does make mistakes and these, usually, are on a grand scale. The news media will sometimes carry a squib about the subscriber who suddenly receives thousands of copies of his favorite magazine, or what is not uncommon, the suddenly paper-wealthy individual who had expected a small check.

All computers do have means for checking and double-checking their own

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[33] Ibid.

[34] Chicago Sun-Times, March 13, 1968, p. 59.

[35] Ibid.

operation; normally, the problem cannot be traced to the machine. It is usually the case of some "exception" that has occurred in the processing cycle for which the programmer has not made provision.

Roy Bongarty[36] reviews a number of these "goofs." A bank in California, familiar with the effort required to credit and account for $2.00 improperly charged to it, instead, had one of its officers take the customer and his wife out to a show and dinner.

The Banker's Trust of New York found a curious case of exceptionality that its computers could not handle; a great number of its certified checks began "bouncing." The computer was not programmed to identify the word "Certified" and would again debit the customer's account; it was first debited at the time of creation of the check certification. The only solution was to punch a hole in the magnetic account number encoding. This kicks the individual check out of the peripheral equipment and permits individual handling.[37]

The ticket reservation system at the Lincoln Center Reperatory Theater in New York suffered at the hands of a computer. It made such a mess of the ticket system that it took a human staff forty-five days working twelve hours a day to correct it. With the new method the work is done by a girl at a cost of $900 for the season; the computer cost was $6,500.[38]

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[36] Roy Bongarty, "Fold! Spindle! Mutilate!," True, Volume XLVIII, No. 368, January, 1968, pp. 44-45; 66-68.

[37] Ibid., p. 45.

[38] Ibid., p. 67.

CHAPTER VI

UNIQUE APPROACHES IN GOVERNMENT

Government has always been the largest user of EDP equipment. Because of this, it has, in certain respects, acted as a standardizing agent. At one time individual manufacturers all went their separate ways with little concern for what other manufacturers were doing. This resulted in little compatibility between equipment manufacturers. Recognizing the tremendous waste of this approach, the Federal government, as it became more sophisticated, began to demand hardware and software to its own specifications. The government was also instrumental in involving the industry in the development of COBOL, the Common Business Oriented Language that will, with very slight modification, work with all manufacturers' equipment.

As was done with Business in Chapter V, this chapter will briefly examine some interesting ways in which the Federal government is using EDP.

A. A Computer Union

The application considered by Louis Dombrowski[1] does not come under the aegis of the Wagner or Taft-Hartley Acts but is, rather, concerned with the linking of government, business, bank, and other institutions' machines on a

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[1] Louis Dombrowski, "Government Computer is Computer's Auditor," Chicago Tribune, March 13, 1968, p. 8, section 3.

nationwide basis. Although the scheme sounds far-fetched, the present-day technology could well accommodate it, and much good thinking and necessity would dictate its establishment.

The General Accounting Office, whose job it is to oversee certain government expenditures, now uses a computer to keep track of the 3,000 installations that the government leases and owns. Their job would be vastly simplified if it were coordinated by a central unit with access to all the other units.

A large segment of the economy depends on up-to-date statistical information that, today, requires undesirable time lapses for completion and reporting. Vast computer-to-computer networks could conceivably change intermittent reporting to continuous reporting.

The Federal Deposit Insurance Corporation recently reported on one of their new applications that cut a seven to nine month job down to sixty-three days and could have reduced it to two weeks had not the member banks been tardy in submitting their returns and careless in producing a high percentage of errors.

> It is not too many years in the future when computers of the Census Bureau, the Commerce Department's Office of Business Economics, and the Bureau of Labor Statistics will converse with computers around the country and determine the shifts in the economy almost as soon as they occur. Minor adjustments in monetary or fiscal policies would permit the Federal government to stimulate or slow down the economy as needed.[2]

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[2] Ibid.

B. Governmental Planning and Research

Planning for future civic needs requires a great deal of intelligence and information. The complicated nature of today's civilization and the accelerated growth of urban centers imposes problems the nature of which are difficult to prognosticate. For example, the Systems Group of TRW of Redondo Beach, California, realizing the inherent need for a scientific approach, felt that it could fruitfully use its experience and manpower in solving these problems. The TRW decision encompassed health, transportation, and urban planning.[3]

They could see themselves as being the overall planners of a brand new city, providing every one of many thousands of details that goes into an enterprise of this nature: site selection, landscape and architectural design, water conservation, road construction, etc.

The municipality of Alberta, Canada hired TRW to build an $88 million medical complex. TRW put its knowledge and computer systems and people to work in order to solve this problem. The net result was an initial saving of $6 million and a reduction in the number of buildings from ten to six. The operating costs were reduced between $4 and $10 million a year.

A "milestone" contract to provide high speed transportation between Boston and Washington is now under investigation. Will it be pneumatic tube,

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[3]Edwin Darby, "A Systems Approach to Profits," Chicago Daily News, October 5, 1967, p. 104.

monorail, or aircushion? The computer will supply all of the relevant data on which a decision will be made.

C. FBI in Peace

A new type of bank robber has come on the scene to plague American business; the bank loan merchant who uses stolen negotiable securities for collateral. When the loan goes into default and the bank tries to sell the securities, it is discovered that they have been stolen.

Presently, the serial numbers and other means of identification of 50,000 securities are being stored in the memory of the FBI's computer in Washington. Once the system is operative, a bank, before making a loan, will make inquiry of the local police concerning the collateral. The police will have the capability of querying the computer in Washington.

It is expected that this method will result in great savings for the government in terms of the cashing of government bonds illicitly obtained.[4]

D. United States Air Force

The United States 7th Air Force in Viet Nam is presently installing and designing the most sophisticated military system in existence. The communication system will link fifteen major fighter bases in Southeast Asia.

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[4]Leonard Weiner, "Computers Dog Modern Type of Cycle," Chicago Daily News, January 11, 1968, p. 57.

The central unit is an IBM360 unit with ten auxiliary computers. They will function to give instant results of combat strikes and the status of aircraft and crews. It "will give the air-war planners an after-the-fact analysis of what happened. It will tell them not only what happened, but why it happened."[5]

The system called the "Pacific Air Force Interim Automated Command and Control System," is expected to pay for itself in one year through improved air lift operations.

E. The Social Security System

The federal government was the first to utilize commercial computers and since then has been a pioneer in their use. The Social Security Administration (SSA) with overwhelming amounts of information relating to many aspects of almost everyone's life probably handles more data than does any organization, either public or private.

The SSA had its first computer installed in 1956. This was an IBM705 vacuum tube system with a memory unit of 40,000 characters. Vacuum tubes generate a great deal of heat and the process of keeping the unit cool and in repair was a large job in itself.[6] By 1961 two of the three 705 units had been

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[5] Chicago Tribune, "New Computer System in Viet Nam to Aid Air War will Speed Data for Fifteen Fighter Bases," January 21, 1968, p. 20.

[6] Joseph L. Fay, Data Processing in the Social Security Administration, (Washington: U.S. Government Printing Office, 1967), p. 7.

replaced by an IBM7080 installation, a transistorized, low-heat generating unit, with a speed six times greater than its predecessor. Two more 7080 systems and nine IBM1401 systems were subsequently added.[7] The 7080 EDP systems, due to their extremely high speeds, are primarily tape-oriented; all information going into or coming out of the system is recorded on tape. In most instances information coming into an office is typewritten. Normal procedure is to transfer this to the familiar eighty column IBM card with a keypunch machine of which SSA has 775 units. The 1401 system accepts the IBM card and stores the card data on tape reels. These reels are made compatible with the larger unit and in actuality are "slaves" to it.

The SSA uses computers to:

1. Establish an account.
2. Update earnings records.
3. Locate employer's reporting errors.
4. Compute benefits.
5. Project SSA and other government agencies program requirements.
6. Supply statistical reports to private corporations, unions, and business on a cost basis.[8]

It is indicated that all of the present-day functions of the agency could conceivably be performed without computers, but the cost would be millions of dollars more.[9] Also, the tape concept of storing information results in the savings of great volumes of space; only 750 tapes contain all of the SSA's individual account information. The entire system is interrogated every day in

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[7] Ibid.

[8] Ibid., p. 47.

[9] Ibid.

about eight hours by searching ten tapes at a time.[10]

As one of the pioneers and largest users of EDP equipment, it seems natural that SSA should have continued to develop new approaches. A number of these will be considered.

Microfilm - An innovative approach to microfilm usage has been the SSA's development of a system that will take information from a computer tape and place it on microfilm. In order to process upwards of a million accounts a day it takes a great deal of equipment and manpower. Even a small time-saving step could represent large savings in time and money.

At one point it was necessary to print-out the information in a photographic manner and then have the camera copy it, a slow process in terms of a large volume. The SSA approach eliminates the slow print-out step. The tape record is fed into a device that displays the information on a cathode-ray screen. A high-speed camera photographs the screen information at a speed of 18,500 characters per second.[11]

Tape Reporting - With a large number of companies using EDP it was decided that a time-saving method of reporting would result in direct submission of magnetic tapes. This benefits the government to the extent of $12,000 per million items and a saving to the employer of converting to paper reporting.[12]

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[10] Ibid., p. 54.

[11] Ibid., p. 53.

[12] Ibid., p. 54.

An Integrated Approach - SSA defines an integrated approach as "gathering data from remote locations and channeling them to a central point for processing."[13] The claim process aspect appears to be their most interesting application.

A claim is initiated in one of 600 field stations distributed around the country. The pertinent information is then punched on tape and sent by wire to a collection office that serves eleven other offices. These, in turn, "batch" the claims together and send them to Baltimore where they are received on magnetic tape. Baltimore sequences them in the proper form for purposes of searching their tape files. When the computer isolates each account, it selects the information needed and places it on an "output" tape. A reverse of the reception process returns the requested information to the place of origin.[14]

Optical Scanning - Every quarter of every year the SSA receives an earnings report on over 60 million persons coming from 3.4 million tax returns prepared in a variety of media.[15] A device that could capture this information on a tape without human intervention, punching out the data on an IBM card, would represent a saving of tremendous proportions. An optical scanning device, operating in conjunction with a computer appears to be the logical answer to eliminating this "logjam."

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[13] Ibid.

[14] Ibid.

[15] Ibid., p. 56.

Through the use of an optical enlarging system, an electron beam scanning device, and a computer in whose memory is stored a table of characters, each original document is "read" and its information placed on tape. This process takes place at a rate of 500 characters per second, processing 6,400 lines per hour.[16] Familiarity with the work of an expert typist gives one an appreciation of this machine's capability.

Government has always been in the forefront of computer research. It is the largest user of information and as pointed out in this chapter realizes the most benefit from new developments. The federal government has recently funded research in fourth generation technology, termed Large Scale Integration (LSI). The advent of fourth generation devices will revolutionize an industry that has seen two upheavals in less than fifteen years.

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[16] Ibid.

CHAPTER VII

EDUCATIONAL EDP - A COMPREHENSIVE EXAMINATION OF APPLICATIONS

This Chapter will explore the manner in which particular educational institutions are using the electronic computer and its associated equipment.

Because the computer is a tool for advancing the informational aspects of the education process, each institution seeks to evolve an approach commensurate with its own unique problems. In all instances installation of EDP equipment is initially predicated on more efficiently performing tasks that had previously been done largely by hand or with the aid of such simple machines as adders, calculators, electronic accounting machines, etc. The increased cost of operating an EDP system precludes limiting it in this manner; it is imperative that more tasks be found that would justify the expenditure of the additional monies.

The key concepts involved in the utilization of this electronic medium are the manner in which information is stored, retrieved, and displayed. The ensuing pages will be concerned with describing some of the services performed by selected EDP installations in Illinois with a particular concern for unusual approaches where such may exist.

A. Chicago Public Schools

The Chicago Board of Education has been a pioneer in the use of electronic computers for educational information purposes. It has used these devices since 1961, a year after the General Electric Company completed a feasibility study that recommended their installation.

The school system is responsible for the education of nearly 600,000 students and has a staff of approximately 30,000 persons. The EDP Department is charged with the responsibility for keeping all of their records. In addition it must keep track of the receipts and expenditures in a budget that borders on $400 million a year; the physical inventory in some 600 schools, and the many kinds of research that such a large educational institution can undertake.

Operation of this system requires a large amount of computer hardware. Two IBM1401 systems, one IBM1460 system, and IBM7074 system and all of their associated hardware occupy approximately 7,500 square feet of floor space in the Board of Education building.

All of the computers are second generation, utilizing solid state devices in place of vacuum tubes. About three years ago computer technology evolved into its third generation and, for purposes of large volumes of work, has rendered the second generation obsolete. In recognition of this there is now on order an IBM360-50 system with delivery expected in September, 1968. Conversion to the new system is planned in three phases and will not be completed until June, 1969.

The EDP Department consists of personnel in four distinct divisions: Systems, Programming, Operations, and Education.

Systems - This is the group of persons who are responsible for planning the work and procedures of the department. They act as a link to the other departments in the overall system in order to determine their needs and explore the most expeditious manner of meeting these requirements.

Programming - Computer hardware requires complicated direction in order to produce the large volume of work that it does. In reality every machine is a maze of wires and components lacking the ability to direct itself in even the simplest task; without explicit instructions as to the specific steps, even adding one and one would be impossible for it.

Computer programmers are the people who direct the internal workings of the machines through long series of instructions, termed programs. Theirs is the challenging position of devising programs on paper that will make maximum use of the machines' capabilities.

Operations - In this category are the individuals who control the mechanical functions. Typical of this category would be the operators of the computer console; the persons who manipulate the tabulator equipment; those responsible for producing the input data to the machines; and those retrieving and distributing the output data.

Education - The new and dynamic nature of EDP requires training and education at a number of levels. In-service education is provided for school administrators and other clerical staff. This enables them to become acquainted with procedures of the system. The courses last five days and can be taken on

consecutive days or, in the event that the individual cannot be spared from his school, can be taken one day at a time in succeeding weeks.

A field staff functions in direct contact with the schools to keep their personnel informed of new approaches and for purposes of smoothing-out problems that may arise.

Hiring of programmers and other technical people presents great difficulty; the public nature of the school system makes it difficult for schools to compete financially with private business. In many instances it has become necessary to establish classes to teach this skill. Beginning in 1963 the Board of Education introduced a series of college level courses through its then affilliated colleges in order to prepare teachers to teach courses in EDP and through the Junior Colleges to prepare technicians for the industry.

A number of high schools have introductory courses in their curriculum. Through the use of a teleprocessing network the students are able to connect into an IBM computer located in downtown Chicago. These facilities have also been extended to other areas of the curriculum; students in physics, mathematics, and science courses are availing themselves of the tool.

An important concern in embarking on an EDP venture is the nature of the Master Record and the information that it will contain. Too little information will limit the tasks that can be performed, while too much information will slow down the operation of the system.

Means of information storage: cards, tape, or disk have varying limitations and advantages. Cards are bulky and must be handled mechanically. In addition, they are subject to all of the vagaries of human interference. Tape

can contain vast quantities of information in a small area, but it must be searched in a serial fashion for locating specific records. The disk, which has the quality of being randomly accessible, is the speediest method but has certain economic drawbacks. Selection of a particular mode of storage is dependent upon the manner and frequency of treatment that specific data require.

The record-keeping scheme of the Board's EDP Department encompasses five general areas of concern: Student Accounting, Staff Accounting, Finance, Materiel, and Research.

1. Student Accounting

A Student Master Record contained on magnetic tape for each student in the Chicago Public School System is the basis of the Student Accounting System. The ultimate system will be comprised of five sub-systems: Membership, Scheduling, Attendance, Test Records, and Subject Grades. The first two are presently in operation, whereas the latter three are to be incorporated at such time as is deemed feasible.

Tape storage is used for the Student Accounting function because of its relative permanency and the infrequency of the up-dating cycle; a once-a-week sequential search of the files is adequate for purposes of keeping the records current.

Membership - The basis of the entire system rests on the individual student's complete identity record. Each student is assigned a unique identification number when he enters the school system and retains this wherever he goes within the system. No mistakes are possible because all of the numbers

are pre-printed on adhesive labels by a computer.

The large volume of records maintained by a school system of this size required an innovative approach to the handling of information; keypunching of upwards of a half million records onto punch cards while at the same time effecting the continuing changes of a big city school system, would have been an insurmountable task. A contract was effected with Recognition Equipment Incorporated of Dallas, Texas to develop an optical reader device that would handle typewritten information on standard size sheets. Subsequently, each school in the system has been furnished with an IBM Selectric typewriter with removable type fonts, one of which is especially designed for receptivity by the optical reader.

Equipped in this manner, it was now possible for the schools to prepare the original source documentation for each student in attendance. As changes are effected in each student's status or in the entire school's roster at the end of the year, the proper forms are available to the individual clerks to make the changes. Once prepared, these forms are sent to the Board's downtown office and processed by the Optical Reader and its associated equipment.

Registration - This is initiated by the office of the school in which the student first enrolls. An Enrollment Form, requiring the insertion of a great deal of identifying information is filled out by the accompanying adult or the school clerk. Information from this form is inserted onto a Registration Form (Figure 1) with the aid of the Selectric typewriter. The Registration Form is sent downtown and "read" into the Student Master Record magnetic tape file through the Optical Reader.

An additional part of the original entry procedure is the production of a Status Card (Figure 2). This has two parts. The left-hand portion contains identifying information, whereas the right-hand portion is machine readable and is used to effect changes in the student's status.

Changes that can be made in the student's record are indicated by referring to the Status Card:

1. The transfer to a non-Chicago school is typed in as are changes in Chicago address, Zip Code, or telephone number.

2. Six additional changes can be made by entering the new information in a blank above the appropriate column and then mark-sensing the appropriate spaces in that column.

3. Any other change requires filling out a new Registration Form, being certain to retain the same student identification number.

Every change in a student's record results in the production of an updated Status Card and the destruction of the old card.

With a record of all students available on a few rolls of magnetic tape, any conceivable function of arranging, listing, or tallying of pupils can be carried out. All that has to be done is have the IBM7074 computer search the file for the particular category or status of student, and as it finds each one, list his name and desired information on another roll of magnetic tape. This procedure in no way changes the Master File; it remains intact.

The newly created list on magnetic tape is manually removed from the 7074 machine and placed into one of the IBM1401 computers. The 1401 is a slower and much smaller computer, suitable for operating a high speed printer. The 7074 is too fast a machine and would not operate economically if connected

to a slow-moving printer.

Under the direction of the program stored in the 1401 computer, the printer will print any kind of list, report, or form containing the information desired. In the event that multiple copies are desired it is possible to print on a duplicating master and reproduce as many copies as are necessary.

Scheduling - The scheduling of high school students is a task of major proportions. The electronic computer is so constituted that it can relieve the teaching and administrative staff of this burden and do the job in a more effective manner. The EDP scheduling procedure does not intrude on the students' four-year plan, nor does it in any way involve itself in the counseling decisions of the administrative personnel. A Master Schedule is created by the administrator and each student is fitted into this on the basis of his own considered subject elections. The computer will not make a value judgment concerning his selection; it will, however, reject any choices that create a conflict.

The foundation stone of the scheduling procedure is the five digit Code that identifies each subject taught in the school. The digit positions are identified as follows:

1 - Department
2 - Subject level.
3 - Individual subject within a department.
4 - Consecutive term of instruction in the subject.
5 - Special subject identification within the school.

Preliminary Operations in Scheduling - The scheduling process begins with the EDP Department programming the Master Student File to print out a form

HIllDP in duplicate (Figure 3) for each ninth through eleventh grade student in each high school. The original of this form can be "read" by the Optical Reader, and its contents can be stored on tape for use in the scheduling process. The duplicate copy is a work form and is used for the handwritten entries as indicated.

The student's program is first worked out on the Work Form of HIllDP. The subject elections are then transferred to the original in ascending numerical order with one subject election to a box. The Code number for each subject is then mark-sensed in the program target area. All of the subject election forms are then batched together and returned to the data processing office.

The data processing department submits the entire group of subject election forms for the individual school to the Optical Reader. This mechanism reads the information off of all the forms and places it on a Subject Election Tape.

This tape is then used to prepare a Subject Election Recorded List (Figure 4), which is a school master breakdown for each student, his identification, and his subject elections.

When it is indicated that the Subject Election Tape is relatively complete Data Processing uses it to prepare a Subject Election Student Tally (Figure 5), which indicates the number of students requesting each subject by appropriate Code number. From this a decision will be made concerning the courses to be eliminated from the Master Schedule.

A Potential Conflict Matrix (Figure 6) is prepared. This is a student

tally for each pair of subjects having less than forty requests. It supplies the counselor or administrator with an indication of the conflicts that may occur and enables him to eliminate them, depending on their specific nature.

A Subject Election Course Roster (Figure 7) is also prepared. This is a breakdown by subject of each student electing a particular subject. By this means specific students can be located who might require a subject change. This list must be checked for improper enrollments, i.e., boys enrolled in a girl's gym class or freshmen enrolled in upper-class subjects, etc.

Master Schedule Preparation - The computer program for processing the Master Schedule has certain limitations that must be recognized:

1. The computer cannot make a value judgment concerning the schedule. It assigns the students on the basis of the information provided.

2. A class meeting more than twenty times must have two subject Code numbers and each must be elected by all students.

3. No more than 400 unique subject numbers can be processed.

A Master Schedule Listing (Figure 8) is the form prepared by the school to define the parameters of its scheduling operations. This is done in conjunction with the Master Schedule Preparation Chart (Figure 9). The designations on the Chart under Field Name: Page Number, Line Number, Teacher Position Number, etc. refer to the horizontal columns in the Listing and is used as a guide for those responsible for filling out the Listing. The Chart defines the information that is required for the six different school activities: study halls, lunch-rooms, single period, multiple period, late starts, and activities.

The Master Schedule Listing must be prepared on the IBM Selectric in order

that it can be read by the Optical Reader. Once this is done, the computer will process each student and prepare a printed program for those that can be accommodated. A separate list of unassigned students is prepared with an accompanying code number indicating the reason for the computer's inability to make an assignment. When a partial program assignment is possible, it will be done.

In addition the computer will also print-out the following reports:

Room and Teacher Assignment Reports - The former identifies two subjects scheduled into the same room at the same time. The latter is a listing of each teacher's schedule.

Master Schedule Seats Left Report - A breakdown of the number of seats unfilled in each class is identified.

Purged Listing - A list of those students removed from the Subject Election Tape is made.

Students for Whom No Subject Elections Have Been Received - Students on the Master File for whom no Subject Elections have been received are recorded.

2. Teacher Accounting

The Chicago Board of Education has a different approach to teacher accounting than it does to student accounting. The reasons for this are inherent in the nature of the task; teachers' files require more frequent reference by the downtown office that do student's files; every two weeks teachers have to be paid and certain reports generated.

Teachers' records are maintained on an IBM1301 Disk Pack File with each teacher identified by a five digit number. A complete IBM1460 Computer System is allocated to this particular task. The entire system operates on a real-

time basis with a multi-programming feature and the ability to print output documentation.

The most interesting feature of the system is the use of Bunker-Ramo Video Tubes located strategically in the Board of Education building. These have the capability of displaying information contained in the file to persons authorized to examine it. They have the additional capacity, through the medium of the video tube, to effect changes in the stored information if desired.

Security requires that access to the files be limited. Identification is made by tapping-in one's social security number with an additional identifying suffix. If the inquirer is qualified to receive information at that terminal, clearance is granted and the system can be queried. The requested information is then displayed on the video tube for inspection and, if desired, modification. At the end of the day a print-out is run that identifies every transaction in the file and those that affect it.

3. Finance

An outstanding example of the system's advantages is the rapidity of end-of-the-month financial reports; this information is available within three days.

The finance function is up-dated daily on the 7074 computer. The entire tape file is reproduced on a disk pack and whatever processing is required takes place. The information is dumped back on the tape file following completion of this process. The teacher file is the only information that

remains on the disk pack all of the time.

A constant internal check is made of a variety of items about which it is necessary to have information. What is the status of a particular vendor? What is the budgetary status of a particular account? The computer can answer many similar questions.

All payments and the writing of all checks are done by the computers and their auxiliary equipment.

4. Materiel

All aspects of physical inventory are handled except for that of manual counting. This allows programming for the availability of stock, the preparation of re-order notices, the picking and packing lists based on trucking schedules, and the production of inventory reports.

In conjunction with the Audio-Visual Department a method has been developed for taking physical inventories of films and filmstrips. It has resulted in the analyses of film needs in eight different ways. Special science-materiel statistical reports are also produced for the school authorities.

5. Research

With the introduction of EDP and the capability of handling information at what before would have been regarded as impossible speeds, the researcher can now undertake tasks that previously were regarded as beyond human capability. He has been freed from manipulation of figures and can concentrate his efforts on their significance and interrelationships.

Computer research in this system is geared to three areas:

1. Programs which simplify and render research more efficient.
2. Using sophisticated mathematical and statistical concepts and making them available to educational personnel in their exploration.
3. Teaching selected personnel the use of Fortran, a mathematically and scientifically oriented computer language.

B. New Trier High School District

New Trier is a two-campus school located in Winnetka and Northfield, Illinois, serving a number of Chicago's north suburban communities. Its student body is approximately 6,000.

The main body of EDP equipment consists of an IBM1401 computer with 8,000 characters of information storage. It is a disk oriented system with two IBM1311 Disk Pack Drives. There is a printer, a card reader and punch, an interpreter, and a sorter-reproducer. Tape drive mechanisms are not presently a part of the hardware scheme, resulting in inadequate information storage facilities. Their absence requires that all computer programs be stored on IBM cards.

There are three major information files contained on disk pack: the Master Student File, the Course Record File, and the Master Schedule File.

1. Student Accounting

Each student record is 300 characters in length. It contains his personal data, his course list, his study halls, and the activities for which he is registered.

The Course Record File identifies each course section in the school with a unique number, which appears on a printed list containing the name of the course offered, its location, and the name of the teacher. It is an extremely flexible and useful device because the school is on a track system which allows students a great deal of latitude in changing classes. There are about 3,000 program changes every semester either in their courses or activities. An alteration can easily be made by simply changing the ID number.

Program Selection - Each year's processing begins with computer printed cards (Figure 10) that are sent to each student's home and requires the parent's signature indicating approval of the student's selections. The student has made these selections by simply listing the ID number of the courses that he desires on a pre-printed card, and the computer searches its files and prints-out the course titles.

A total of about 35,000 course and 20,000 study hall assignments are made every semester. A human task this size would be overwhelming, but to the computer functioning at a nano-second rate, it is a loafing job; a good part of its time is spent resting, waiting for the peripheral equipment, disk, tape, printer, etc. to accomplish their task.

Grade Reporting - A pre-printed IBM card (Figure 11) for each student in his class is furnished to each teacher. It is a mark-sense device which is then "read" by the computer into the student's record on the Master Student File on a disk pack. After all of the grades have been credited to the student's record, a program is executed on the computer that prints out the Grade Reports (Figure 12) in five copies for the student, the office, the

adviser, the chairman of the department, and the dean. At the same time that this printing is going on, the computer checks to determine that there is a grade for each course for each student registered.

Scheduling - The schedule of New Trier is complicated and requires highly sophisticated computer equipment such as the IBM360, a third generation device, in order to accomplish the task. For the last couple of years it has been possible to purchase time from a commercial organization to perform the scheduling function. This has been done using five hours of machine time for a total cost of $200.00. All of the information for carrying out the program on the larger computer is prepared on the high school's equipment. The completed information is returned to the high school where it is used in any manner that might be needed.

Study Hall Scheduling - Prior to the arrival of EDP at New Trier, the staff's most exasperating job was the economic scheduling of students into study halls. The computer does the job as efficiently as is possible and prints out a Seating Plat (Figure 13) that schedules students for each seat in each study hall for every period and every day of the week. It identifies the occupant's name, his ID number, and his adviser's name.

Attendance Reporting - Each teacher takes class attendance by turning in a pre-printed IBM card. These are listed by the computer on a duplicating master and copies are sent out to all of the teachers. The computer also enters the absences into an Attendance File that is contained on a disk pack. At the end of each quarter a list is printed (Figure 14) containing each absence and each tardiness for every student in the school. The computer program has provision

for checking against a previously determined maximum number of these indiscretions. When such is found, the individual is "stored" on a separate portion of the disk file. Upon completion of the listing procedure, a printing procedure goes into operation that extracts each parent's name from the Master Student File and instructs the printer to address a pre-sealed communication to the parent indicating the excesses.

2. Test Item Analysis

The teachers have available to them an excellent test item analysis program written by Cecil Badner, the Director of New Trier's EDP installation. It has proven so valuable that IBM has included it in its programming library. The program prints a complete analysis (Figure 15) of each question, the nature of the number of responses to the correct answer, and also the responses to the distractions. A discrimination index is calculated by the computer; the result is characterized by the term O.K., dubious, or poor. An index of difficulty is also calculated, and the results of this are expressed as optimum, easy, or very easy.

A "flag" is exhibited in the Distractor column of the print-out indicating the distractor that was chosen by more high scorers than low scorers. At the end of the test the computer prints-out a Kuder-Richardson Formula 20 reliability coefficient.

It has been found that this program is not too popular except among the mathematics teachers. The large number of figures seems to intimidate people.

3. Financial Applications

The EDP Department handles the more mundane tasks of a simple budget accounting system that merely shows where the money went. The system is on a cash basis and no encumbering is done.

Flow Charting - As in any area of human endeavor, a well-prepared plan insures an efficiently functioning organization. In EDP, systems planning is done through the flow-charting technique. This allows all persons concerned to visualize the various steps in the procedure. The following description refers to the Flow Chart of Disbursements and Budget Distribution (Figure 16):

> Invoices (1) are punched-up as Disbursement Cards (2) which, in turn, are used for two separate functions. BUD01 (3) is a computer routine that gives a TOTAL of all disbursements and lists them. Their second purpose is a SORT (4) in vendor order followed by the BUD06 (5) routine which checks the sorted cards against the Vendor File (6), which produces a Check Register (7) and also stores the information on the Disk File of Check Records (8). BUD08 (9), a computer routine, produces the Disbursement Checks (10).
>
> Another computer routine (11) sorts the check records on a disk and produces the Disbursement Records in Budget Code Order (12), which are stored on disk. These are used by BUD10 (13), a computer routine, to print a list of bills for Board approval (14), while BUD21 (14), another computer routine, in conjunction with Budget Accounts File (15) produces a Detail Disbursement Listing (16) (Figure 17) and an up-dated BUDGET ACCOUNTS FILE (17) on disk storage.
>
> The latter disk file (17) is used by the BUD30 (18) computer routine to produce a Budget Account Balances As of End of Month (19) (Figure 18). BUD40 (19) uses the same file to produce a Recap Report for Board (Figure 19).
>
> BUD22 (20) takes the BUDGET ACCOUNTS FILE (15) on disk in conjunction with Receipts and Adjustments (21) that have been punched into IBM cards and produces a printed Detail Listing (22) as well as being used to adjust the UP-DATED

BUDGET ACCOUNTS FILE (17).

Payroll - New Trier uses an IBM program package specifically designed for Illinois Public schools. Some modifications were required because the IBM package pays twice a month or every two weeks, whereas New Trier issues checks on a monthly schedule. The entire operation is handled by one person on a part-time basis. Its efficiency is evidenced by the fact that W-2 forms are printed and mailed by December 21st.

C. High School District 214 Mount Prospect, Illinois

District 214 is the largest high school district in the State of Illinois. It is located in a fast-growing suburban area northwest of Chicago. Its present student population is 12,000, increasing at the rate of 1,500 to 2,000 per year with an expected peak of 27,000. The District consists of six schools: Arlington, Prospect, Forest View, Wheeling, Elk Grove and John Hersey. A seventh building is tentatively planned for the fall of 1970.

The EDP facilities are located in the District's administration building in Mount Prospect, Illinois on the campus of Prospect High School.

An IBM1401 computer with 12,000 characters of storage in association with two IBM1311 Disk Drive mechanisms comprises the main body of EDP equipment. The peripheral equipment extends into each of the high schools with each having an IBM1050 Teleprocessing Terminal, a keypunch, and a sorter mechanism.

1. Student Accounting

A Master Student File consisting of 200 characters of information for each

student is contained on a disk file. All of this information is of a broad background nature with nothing relating to the individual's coursework. This Master File serves only as a general information repository for servicing the individual schools with any type of pre-printed copy that might be desired, i.e., class lists, grade reports, mailing labels, and a myriad of other repetitive tasks more efficiently and effectively done by machine.

All student accounting is decentralized. Each building prepares its own input for this function. The central office acts as a resource service bureau; they set up the standards and process the data. Transporting of the completed data product is a physical task of removing the cards from the central office to the schools.

Attendance - At the beginning of the year an IBM card is printed and punched for each student in the school system. Those absent from first period have their cards pulled and subsequently collected. These are then sorted by the machine and the tardy student's names removed.

The sorted cards are then processed by the 1050 Teleprocessor in a home-loop mode, preparing a duplicating master list of the day's absentees. The absence lists are then run-off and distributed to the faculty.

Subsequent absence reporting for the day is accomplished by exception reporting from the list; absent students not appearing on the list are reported on an absence slip, while students arriving after the distribution of absence lists receive an admittance slip from the attendance office.

At the end of the day each school transmits its attendance information to the central office where the information is entered directly into each

student's file.

Attendance Register (Figure 20) - At each week's end the data center prints an alphabetical listing of the students from each building showing the total of half-days absence and the dates. Each attendance register is cumulative for that particular quarter. Also included is a current enrollment summary by graduation date and sex.

State Aid Report (Figure 21) - This is required by the State of Illinois, and it summarizes each school's attendance and enrollment. It is easily obtained from the same disk file that produces the fourth week's Attendance Register.

Student Progress Reports (Figure 22) - Attendance data for the individual student's quarterly Progress Report is readily available on the disk file and is printed-out at the same time as are the student's grades. The Progress Reports ordinarily are distributed to first period teachers to be given to the student, however, failing and incomplete grades are automatically printed inside of a mailer envelope and posted to the pupil's home.

With the Teleprocessor each school has a great deal of flexibility in terms of "paper shuffling" tasks; all kinds of listing burdens have been removed from the clerical staff. Typical of these would be: Homeroom lists, parent's list, failure and incomplete lists, study hall lists, mailing labels, etc.

Scheduling - The EDP center has done all of the school scheduling for the past three years. Previous to this it was done by the IBM Data Center. Each school develops its own master schedule within its own set of standardized

parameters developed by the EDP Center. The students' records are then loaded into the program and individual student schedules are printed-out by the computer. Any conflicts that might exist are reported back to the school for resolution.

Miscellaneous Applications - A complete list of all applications would be too lengthy; many of the individual schools perform minor tasks which the central office does not control. A number of the more important ones would be as follows:

1. Teacher assignments.
2. Bus assignments.
3. Summer school course planning and grading.
4. Enrollment projections -- collected from elementary schools.
5. National Honor Society calculations.
6. Gummed label printing of test scores to be attached to permanent record cards.

2. Payroll Accounting

The payroll function is simplified to the extent that concern is displayed only in terms of exceptions. Otherwise, each employee is paid a standard amount with deductions qualified at the beginning of the year. Any changes that might be required must be instituted by the business office with a punched card.

Payroll worked so well on the computer that it was decided to extend the service on a cost basis to any elementary schools that might want it. Two of these are now taking advantage of the opportunity. Those that are, have had to make small modifications in their own approach, but the results were well

worth the effort. No charge is made for the use of the computer and the other schools pay the data processing personnel directly, giving the high school district additional income. Incentives of this nature can possibly be the difference between retaining skilled personnel or losing them to more lucrative positions.

The Payroll File contains the personnel information for the district with complete biographical data, indicating each teacher's building, duties, salary, and insurance.

3. Budget Accounting

The budget accounting procedure is done on an encumbered basis. Each beginning balance is entered into a disk file, and all transactions and continuing balances are retained there. Every transaction, purchase order or payment, generates a punch card and is identified by an eleven digit code. When an invoice arrives the purchase order is dropped; the necessity for this lies in the difference that usually occurs due to discounts, shipping charges, and other discrepancies that cause a difference between the two figures. In order that it be kept current, the budget is unencumbered every two weeks.

Reports to the business office are made on a weekly basis in the form of a grand total. The reports to the individual school are self-contained.

Disk storage has great value in preventing perusal of the budget accounts by unauthorized personnel. It also cuts down on the loss and mishandling of account cards.

Projection of cash needs enables the district to invest its excess funds

on a ninety day basis. Revenue from this source varies from $50,000 to $60,000 per year and is much more than was realized before using this tool.

The purchasing agent has developed a purchase order code that simplifies computer analysis of district expenditures. In previous years initial purchases of expendable supplies were made at the beginning of the year by the central office. Subsequent ordering was done by the individual schools. The computer's ability to project the entire year's needs results in substantial savings.

D. Evanston Township High School

Evanston Township High School has a student enrollment of about 4,800 divided among four separate halls all located on the same campus grounds in Evanston, Illinois, a large suburb adjacent to the North side of Chicago.

Although Evanston has used EDP equipment for less than two years, its penetration, service-wise, has been very effective. The system is so flexible that within a few moments new tasks can be devised for the computer, and within another short period a short program can be written to produce the desired results. The main hardware is an IBM1401 computer with two IBM1311 Disk Pack Drives. An IBM1402 600 line per minute Printer and a Card reader that reads at the rate of 900 cards a minute complete the main body of EDP equipment.

1. Automated Library by EDP

The pride of Evanston's EDP Department is their fully automated library. All books are checked in and out of the library and overdue notices are sent

out by electronic technology. The system consists of an IBM357 Teleprocessor Unit located in the library connected by cable to a keypunch unit in the EDP Department. A disk file stores all information through the use of the 1401 computer.

The ordinary book card has been replaced by an IBM punch card (Figure 23), into which has been entered the usual identifying information as well as a unique Accession Number. Each student has his own plastic ID "Charge" Card. The two of these are inserted simultaneously into the Teleprocessor, which proceeds to punch out an IBM card on the keypunch located in the EDP Department. At the end of the day all of the cards are fed into the disk storage through the computer. This procedure identifies the book withdrawn, it identifies the person withdrawing it, and it also indicates the date of withdrawal.

When the volume is returned, the punch card in the book is inserted into the Teleprocessing unit without the student's ID card. This actuates a "return" punch card in the EDP Department and the book's identification is removed from the disk storage at the day's end update.

Once per week the computer searches the disk file in conjunction with the Master Student File, which is also located on a disk pack, in order to identify books that are overdue. As these are found, the borrower is identified and receives by the computer, a four-copy overdue notice (Figure 24) addressed. The office keeps the last copy and sends the remaining ones to the library, the student's hall, and to the Reg Room (Registration) teacher.

A daily report is printed out for the library showing all of the different classes of books borrowed: science, mathematics, psychology, etc. giving the

library a convenient insight to its client's needs. This report also lists each book that has been borrowed with its complete identification.

2. Student Accounting

The Master Student File, contained on a disk pack, has a complete record of each student since his arrival as a freshman. It is a 300 character file, identified by an ID number, but contains no grades.

A separate disk file contains the student's grade reports and his courses for the year. At the end of the year a label (Figure 25) is printed with this and other information and then affixed to the Pupil Cumulative Record (Figure 26), kept in the main office and in the counselor's file.

Grade reports to parents are printed off of this file onto pre-packaged mailing envelopes (Figure 27). This is a two-part form with the top layer having a soft indelible quality. The thin cardboard bottom contains the grade report. Address printing is done with an inked ribbon, while the additional information is impressed as one would create a stencil on a typewriter, with the information printing only onto the covered card.

At the beginning of the semester class lists are printed from the disk files for each teacher indicating each student's previous semester grade. A myriad of other lists are printed, almost at will, depending on what the need of the school might be on any given day. Once a month a tally is made of the school population by hall and by district.

Attendance - Ten attendance cards are printed for each student, nine white and one green. For each absence one of these is turned in by the first-period

teacher. When the green card appears a new set is printed by the computer. From these cards, submitted by the teachers, a computer program prints out a duplicating master list of absentees. This is then used to supply each teacher with a copy. The cumulative attendance is kept by the individual teacher who reports it at the end of the quarter.

Scheduling - The school is on a modular schedule basis having thirteen fifteen minute time modules a day with a five minute passing time. Scheduling this arrangement is beyond the physical sophistication of the Evanston EDP equipment, and so it is contracted to Stanford University.

3. Budget Accounting

At the beginning of the year the EDP Department is furnished with the amount that each budget contains. This amount is then punched into IBM cards. Encumbering of these accounts is not done by the EDP Department, but each month it does furnish to the business office a print-out of the amount remaining in each account.

Vendors are paid in alphabetical order from the pre-punched cards. This saves the intermediate step of sorting the accounts on the disk file where they have been stored.

The payroll is a highly routinized program furnished by IBM for the 1401 computer and its associated equipment.

E. Lyons Township High School

Lyons is located in LaGrange, Illinois, a suburban community southwest of

Chicago. The school operates two campuses, a South and North, with freshmen and sophmores at the former and upperclassmen at the latter.

The EDP Department, located at the North campus, uses a Burroughs System B283 computer with 9,600 characters of memory and four tape-drive information storage units. The Card Reader is a Burroughs B304, the B321 Printer, operates at a rate of 700 lines per minute, and a Card Punch, B301 complete the major pieces of equipment. In the director's opinion it is quite similar to the IBM 1401 but more efficient.

The business manager of the Lyons EDP system dislikes disk pack storage that is becoming so popular in the EDP industry. His main objections are technical and monetary. Disk systems are necessarily constituted in a manner that permits "reading" information that is on the disk pack and the ability to "write" on the same pack in order to modify information. This allows the possibility of wiping out important information. In order to protect this information, it is necessary to have a duplicate disk file. This is an expensive procedure both in terms of the extra disks, which cost $600 each, and with respect to the machine time required to duplicate the files every time one is modified. Tape drive mechanisms are operated in such a manner that modified information is always placed directly onto a newly constructed tape file. It is not possible to return information to the tape from which it originated.

The Lyons approach to the up-dating of their files makes the most efficient use of the tape media by performing the task on a sequential basis. This eliminates the need for the tape to backtrack in the computer's search for a given record.

If and when Video display units can be remotely connected to the computer, like the Chicago Board of Education, it will be necessary to use disk storage. At such time the disk pack and tape drives will be combined as an integral unit.

1. Student Accounting

The main concern of EDP at Lyons is in student accounting. At present there are over fifty jobs being done by EDP on a regular basis that were formerly the responsibility of teachers, administrators, and office help. The heart of the function lies in an extensive Student Master Record of 1,020 characters of information divided into seven general areas. The various sections of the record are as follows:

1. Identity - Eleven items ranging from year of graduation through birthplace.
2. Status - Seven items defining his school entry date and source through his leave date.
3. Placement - Three items: communications room, locker number and bus route.
4. Achievement - A total of cumulative credits, four items of grade point, and three items of rank.
5. Attendance - Summarization of absence and tardiness.
6. Guidance - Three items of personality appraisal, three items of leadership appraisal, and one set of test scores.
7. Class Records - Ten items of information each relating a maximum of fourteen courses completed.

This probably represents as comprehensive an approach to storage as it is possible to achieve. The only additional information that might be useful

would be follow-up data after graduation. Such, however, would be difficult to justify as part of a flexible system; graduated students would normally be eliminated from the EDP system and become a part of "dead" storage in printed form.

Attendance - The first-period teacher is furnished with a pre-printed IBM card for each student. This is returned to the EDP office when the student is absent and becomes a transaction to attendance tape. The student is then charged with a full day's absence.

Each absent student has his name printed on a duplicating master (Figure 28), copies of which are distributed to all teachers. This list shows the consecutive days absence as well as a year-to-date total. Teachers never have to make an attendance summary. This information is handled entirely by computer. When the quarterly grade report is prepared for the parents, the computer is also programmed to print attendance information on the card.

Grade Reporting - Instructors fill in a pre-printed mark-sense card for each student. These cards are given to a keypunch operator who punches in the grade. Failure and certain special situation cards are sorted out. These are made into duplicating masters (Figure 29) and copies distributed to the appropriate destinations.

All of the grades are entered into the Student Master Record File as is the attendance information on the attendance tape. The Student Master File is then used by the computer to print the Progress Report (Figure 30) in six copies with the original mailed to the parent.

Three times a year class lists (Figure 31) are printed for each teacher

containing the assigned grades for each student through the current quarter. At the end of the year EDP provides a cumulative record label (Figure 32) to be attached to each student's permanent record and also prints a Class Rank Report (Figure 33), which includes percentile ranking, grade-point average, and credits earned.

Scheduling - The actual computer scheduling is done by a data center, but the Lyons EDP Department does the peripheral work; they do a tally of subject elections, a matrix of potential conflicts, and a visual device that indicates pairs of courses taken by students in order to prevent duplicate scheduling. A complete Class Schedule (Figure 34) is printed for each student and mailed to his home at least a week before the beginning of school.

2. Tests (Teacher-made)

A powerful teaching aid, once it gets built-up, will be the EDP Department's approach to multiple-choice testing. The various departments are presently submitting questions for storage in a tape library. Individual teachers will have any of these available to them through a simple coded order form. The computer will search its storage facilities for the requested questions and deliver as many printed copies of the test as are requested with a punched "key." The student punches his selection of answers into a Port-Punch Card and at the completion of the administration, the computer will score the tests and submit a print-out of the individual scores, percentile ranking, and a simple item analysis of each question.

3. Fiscal Work

The EDP Department involvement in fiscal work is limited. Statutorily, the Township Treasurer performs this task with the high school district obligated for the maintenance of his office as he sees fit to maintain it. EDP does print a semi-monthly payroll list and salary deduction information for him.

Some other functions are: the listing of accounts for budget preparation, the listing of salary advance schedules for budget preparation, the listing of monthly accounts payable for payment and for the board report, the printing of the budget, and teacher's contracts.

F. Northeastern Illinois State College

Northeastern Illinois is a burgeoning institution whose campus on the North Side of Chicago is about seven years old. It was one of the first educational institutions to have EDP facilities, which were installed prior to the opening of the school. Because of its original status, that of a subsidiary institution in the Chicago Board of Education structure, its penetration has been limited.

The present equipment consists of an IBM1620 computer with an attached Card-Reader-Punch and an on-line printer. This equipment has been long outmoded in terms of the required applications. Recognition of this has resulted in the institution ordering an IBM360-30 computer with an orientation in both disk and tape drives.

All peripheral storage is now done on IBM punch cards; the installation

has no tape or disk storage. This is a slow cumbersome task requiring that bulky boxes of cards be transported manually and inserted into the computer a few hundred at a time. As will sometimes happen it is possible to drop a box or two of the cards, resulting in the additional task of having to sort them again or possibly even losing a few. The sheer volume of storage required to have the records for a good-sized institution in card form is beyond belief.

1. Student Accounting

The student accounting procedure is initiated when a Permit to Register (Figure 35) is presented at registration by the student. The procedure requires that for each course the registrant picks up a pre-printed Faculty Course Name Card (Figure 36) on each of which he prints his name. The payment of the fees and the return of the Permit and Course Cards complete the procedure.

The batch of cards generated by this procedure goes initially to the key-punch operators where they are punched-out for the individual student's identification.

The cards are then put through the computer card reader and the following documents are created:

1. A permanent student record.
2. Instructor's preliminary class lists.
3. Attendance and grade cards (Figure 37).

The latter is a three-purpose document. The instructor gets one with a green stripe at the beginning of the semester, at which time it is termed a

Class Enrollment and Attendance Record. At mid-term he gets the same form with a red stripe; this is used for D and F grade notices only. The end of the semester produces a blue stripe card onto which the instructor affixes his signature and the student's final course grade.

About the fourth week of the semester, after the class enrollments have been finalized, the computer is used to print-out a four-part carbon copy class list (Figure 38). These serve two purposes: one set is for the mid-term grades and one for final grades with a copy for both the instructor and the office.

At the end of each semester the deck of grade cards is used to print a four-part Grade Report Form with sections going to the Registrar's office, the individual department, the student. The last part is attached to the Permanent Student Record card. The print-out of the Grade Report Form during each succeeding semester encompasses all work that the student has undertaken in the institution. It is easier and more efficient to do this than it would be to add to existing printing because a part of the program consists of figuring semester and cumulative grade-point averages.

2. Test Grading

An EDP function that has proved popular with the faculty in the Test Grading service. Teachers are furnished with Portapunch cards (Figure 39) with the student's name and other identification printed on them.

The tests must be of a multiple-choice nature with a maximum of five answer choices per question. The student is directed to circle the correct

answer until the test has been completed. Afterwards, he is directed to punch-out the answer selected. Students receive an individual identification number which is also punched-out on the left side of the card.

Upon completion of the examination the instructor takes the batch of examination cards with the "key" cards to the EDP Department for processing. They are programmed through the computer and produce the following results:

1. Each student's score.
2. An item count.
3. Frequency distribution.
4. The Mean.
5. The Variance.
6. A point bi-serial correlation for each exam question.

3. Business Accounting

For a long time the only penetration the EDP Department had made into business applications was a concern for enrollment fees and a number of miscellaneous tasks. This was later expanded into health insurance records and the preparation of scholarship lists.

Since July, 1967 the EDP Department has been involved in budget accounting. Three areas are involved: faculty salaries, civil service salaries, and contractual services. A detailed statement is prepared at the end of every month for each department head and for the accounting office, which shows all of the monthly transactions and the balance in each account, including the percentages of expended.

Each transaction generates a separate punch-card. If it is a purchase

order the particular account becomes encumbered by that amount. Payment of the purchase order cancels it out, and the difference is applied either as a debit or a credit.

G. Chicago State College

Computer hardware has been a part of the educational scene at Chicago State since June, 1967. As a former adjunct of the Chicago public schools it had no need for its own facilities, but when it came under state supervision, it became necessary to undertake its own EDP tasks.

The hardware consists of an IBM1401 computer with four tape drives, two disk drives that were being installed at the time of the visitation, a printer, and auxiliary equipment.

The Computer Centre functions strictly as a service organization. It avoids policy-making decisions. This has been difficult to do, at times, because the nature of the service requires that policy decisions be made or the service cannot function. When the proper administrative authority is unable to do so, a void is created that must be filled.

1. Student Accounting

The initial approach to information storage was the institution of a Master Student History Record with each individual record consisting of 750 characters of information. Some of this is not immediately essential but has been collected with the thought that it will prove valuable for future research.

The school operates at the graduate and undergraduate levels and has a continuing enrollment of about 6,000 students. Record-keeping is not an easy task because the enrollment is of a revolving nature; many of the students drop out for a semester or two. Even after graduation many tend to return within a ten year period. At present 11,000 records have been processed into storage, dating back to September of 1966. Current plans foresee picking up all records dating as far back as ten years.

Identification of individual records is done by the social security number rather than randomly as do most EDP functions. It is felt by professionals that this is the ultimate manner in which all persons will be identified. Any changes in the records must be accompanied by the student's social security number or they cannot be effected. Alphabetical listing of names on a college wide basis will not be generated.

The school is on a tri-mester plan with three sixteen-week terms, two eight-week terms, and an early registration procedure for each term. In addition there is an early admissions program beginning in October of each preceding year. The latter function has its own computer program that keeps track of the applicants on a weekly basis with a finalization of the freshman class by about July.

Previously enrolled students receive an Enrollment Envelope (Figure 40), pre-printed with the individual's identification and containing a punched, pre-printed IBM registration card. The student need only write in the changes that may have occurred.

For every course that the student selects he receives a pre-printed

registration card (Figure 41). The comptroller collects the required fees with the course registration cards and inserts them into the Enrollment Envelope, completing the student's registration, which conceivably can be accomplished in less than five minutes. New students require a few minutes more; this is due to the necessity of their entering original information on the registration forms, which are then used to complete a Class Schedule (Figure 42). One copy is kept in the Registrar's office and one in the activities' office.

A Class Card (Figure 43) is printed and each instructor gets one for every student in his class. The printing and punching of this form is a two-time procedure. The first occurs immediately at the beginning of the semester when the instructor receives one with a green stripe across the top for each student in each of his classes. He uses it to record attendance on the left-hand side. At mid-term the same card is used for notifying D and F students. This is done by turning the card in to the Computer Centre, which in turn, sends out a warning notice and returns the card to the instructor.

At the end of the semester another copy of this document now termed a Grade Card (Figure 44) with a red stripe across the top is furnished to the instructor for entering the final course grade. These are returned to the Centre and are used to prepare grade reports to the students and also to up-date each individual's record in the Master Student File.

All of the foregoing procedures take very little time to produce proper documentation. If registration is completed on Friday, class lists can be in the teacher's hands by Monday morning. A week later the instructors are furnished with up-dated lists containing any status changes that may have occurred.

At the seventh week the administration is furnished with a list of the D and F students as is the Registrar, who is responsible for mailing out the individual notices to the students. This office is also furnished with a printed gummed label at the end of the semester for attaching completed scholastic information to the student's cumulative card.

Up to this point all processing has been done on a time-consuming sequential basis because of the tape used to store the records. Disk storage, when it is installed, will save a great deal of time.

2. Budget Accounting

As part of its service function, the Computer Centre has the responsibility for the mechanical aspects of the school's ledger accounts. Encumbering of the accounts is done by the comptroller, but it is the responsibility of the Computer Centre to record and reflect the encumberances of these accounts.

Budget analyses programs are presently in the process of being written. When these are completed it will be possible for the Centre to furnish the administration with various types of information that will enable them to project their increased student enrollment which requires a multitude of increased expense increments. It is hoped that these projections will make the calculations as accurate as possible.

Salary payments come from the State Capitol in Springfield, but the Computer Centre prepares all of the work that enables the State to discharge its responsibility. In order to accomplish this a Faculty and Civil Service Master File, now on tape but soon to be transferred to disk, contains the complete

history of each staff member.

H. University of Illinois, Administration
Urbana, Illinois

The University of Illinois is a large educational institution founded in 1867 under the Morrill Land Grant College Act. Its enrollment, at present, borders on 45,000 students with faculty and staff of about 13,000. The main campus and administrative offices are located in Urbana with eleven separate colleges in operation. There are two branch campuses located in Chicago: the Medical Center, and the Chicago Circle with five colleges.

Electronic data processing at Illinois consists of two separate and distinct entities: the administrative section; and the research section, termed the Digital Computer Laboratory. These are totally separate from one another and have no connection. They will, therefore, be considered separately with initial concern devoted to the administrative section.

EDP in the area under consideration is a tool of the administrative information network which, historically, was instituted when the centralized administrative unit was established in 1947. A staff of about 170 people is responsible for development and implementation of the many systems of data processing that are necessary to the proper functioning of such a large institution.

The main computer is an IBM360-50 with a 512,000 character memory. Attached to the computer is an IBM2314 disk unit that has a 230 million byte capacity and an access time of five micro-seconds. This unit is made up of eight functioning disk drives; a ninth acts as a spare. Nine tape drive

mechanisms are also used; eight of these are nine-track, 1,600 bits per inch. A ninth is a seven-track system used for communicating with a seven-track system. A data cell with a capacity of 400 million characters completes the data storage equipment for this system.

There are two additional computers: an IBM360-40 with associated gear that is used to back-up the larger 50 unit, and an IBM360-20 that is used strictly for card processing.

All processing in the system is of a batch nature with seventy of these batch systems presently functioning through approximately 990 separate computer programs. A batch system accumulates all transactions relative to one area of concern and processes all of them simultaneously. Essentially, it does three things: it collects data, it maintains a file, and it reports on data.

The system's master records are kept on a tape file. They are: admissions record, student record, alumni record, institutional time table, payroll record, student accounts receivable, and accounting record.

There are three major application areas: financial, institutional, and one termed specialty. The latter is a catch-all that includes thousands of miscellaneous jobs that are an intermittent nature.

1. Financial Applications

These are straight-forward approaches towards the balancing of books. The EDP Department has no responsibility beyond the original design of the system, the subsequent processing of the records, and the delivery of the requested reports. Some of the areas of financial concern are:

1. Internal accounting system.
2. Student accounts receivable.
3. General accounts receivable.
4. Purchase order follow-up.
5. Storage inventory systems.
6. Chemistry stores.
7. Office supply stores.
8. Job cost accounting for the physical plant.

2. Institutional Applications

This category includes all of the EDP effort that concerns the student and his educational needs.

Admissions System - Illinois has a selective admissions policy, and it is the function of this system to collect data and select a certain number of applicants based on a pre-determined algorithm. The best, based on grade point average, are admitted first on three separate admission periods.

Scheduling - A timetable system is built by each department on the basis of past history and the projection of anticipated student load. This is published and the students request courses from it. A scheduling algorithm system brings these requests in with schedules and courses and processes the data. This has been so successful that close to 95% of students get the courses they request and over 50% get their exact schedule as requested.

Student Record System - Data are taken both from the admissions process and the previous semesters in order to build up the Student Record System. It is processed and up-dated weekly. The initial thrust begins at the end of the registration period on a Saturday at noon, and by the opening of class at

8:00 A.M. on Monday, EDP has produced a total of 35,000 separate documents with 1 1/2 million lines of information printed-out.

At the end of the semester each student's GPA is compiled, and the necessary academic actions are brought to the attention of the administration. Usually 10 per cent to 30 per cent of the student body is put on probation. The computer does not perform this task, it merely prints out the card directed to the student. The Dean performs the task by signing the card and placing it in the mail.

Alumni Records - This is a file created from the Student Record System. Presently, it consists of about 350,000 individuals with about 100,000 of them being up to date. The entire system is kept on 1 1/2 reels of tape that is updated monthly.

The main function of this system is its use for selective listings and for mailing purposes. For example, the Civil Engineering class of 1912 might want to contact all of its members. A single pass through the file by the computer can produce up to fifteen separate lists. The scheduling of these requests is done through the alumni office which batches them until it becomes economical or timely to make a pass through the computer. If there are fifteen requests the cost is split between them; if there is only one request, that person pays the entire cost.

I. University of Illinois, Digital Computer Laboratory

The Digital Computer Laboratory at the University of Illinois is a giant EDP "factory" that processes upwards of 50,000 jobs a month. The system is so

demanding that IBM's largest third generation computer, the 360-75 is incapable of operating it alone. It was necessary to use an IBM360-50 to supplement it in a unique configuration; the 75 does the computation and the 50 handles the I/O, simulating a human operator. The combination is termed an Attached Support Processor System (ASP). The system is used as a research tool by the faculty as well as by graduate students working on advanced degrees.

Direct control of the laboratory is the responsibility of the Computer Science Department. The department operates at all levels as well as offering graduate degrees in computer science.

At any given time there are 800 to 900 students taking courses in basic computer programming; it is required of all engineering students. A number of hardware, circuit design, and mathematics courses round out the curriculum.

Because of the inter-departmental nature of the enterprise, a committee of the users has been established to help determine laboratory policy. The committee decides when new hardware is required and what will be charged for the use of the facilities.

The system also functions as the basis of Illinet, a group of computers spread around the campus. Presently, the group consists of an IBM360-30 in the Physics Department and an IBM1800 in the Chemistry Department. Hopefully, more large computers eventually will be supported by the Model 50 as it now supports the Model 75. Under this advanced system a person will be able to enter a job from his own card reader in his own office on campus which will be run on any computer that has available time with the completed data fed back to the user.

The Model 75 accepts jobs, one at a time, across a cable from the Model 50. The transmission rate to the machine is approximately as fast as the core memory speed of the latter. Some 800,000 characters per second can be transmitted, while the Model 75 can perform 100 million operations per second.

A high speed drum is used for storage, as well as is the familiar disk pack and tape drive. The drum has a storage capacity of 4 million characters and phenomenal transfer of 1.2 million characters per second. It is about ten to twelve times faster than the normal disk pack and faster than the core memory speed of the Model 50. This feature precludes its being used for any system other than the Model 65 or 75. In practice it is used for what is termed a scratch device, a storage place for reading and writing information that is not required to be saved.

J. Oak Park - River Forest High School
An Audio Information Retrieval System

Oak Park - River Forest High School is located in Oak Park, Illinois and serves the communities of Oak Park and River Forest, Illinois. It has a student enrollment of close to 4,000. It operates on a single campus to which an $11 million addition is just being completed.

With the aid of a computer it is possible for a student at Oak Park - River Forest High School to sit in an individual carrel and listen to any one of 224 taped lectures that are used to enrich the curriculum of the school.

The Audio Retrieval System is the result of two important factors: the need for a service of this nature, and the availability of development funds through the Elementary and Secondary Education Act of 1965.

The system, developed by the Ampex Corporation, represents an innovative blending of two technologies, computers and audio magnetic tape recording.

Seven master tape memory units contain thirty-two fifteen-minute programs each on thirty-two parallel tracks. These operate in an endless tape-loop fashion at a speed of 120 inches per second. This makes a lesson available within a maximum period of thirty seconds.

Each student carrel controls its own single-track student buffer, a tape unit mechanically identical to the master tape unit, but operating as a single track. The student buffer operated in two modes: first at 120 inches per second when it is recording off of the master memory tape, second at a speed of three inches per second when it is playing back for the student.

Each carrel contains a student control display unit that allows the student to order-in a desired program or to communicate with the supervisor of the system. In addition, the display unit indicates the status of the individual unit.

The system is controlled by a Systems Engineering Laboratories Model 810A digital computer. The computer handles all student requests and keeps him informed of their status. The system also provides an extension facility for up to five telephone lines. With this a sick student at home can dial into the school with a Touch-Tone telephone and avail himself of the same audio resource material that is available in the carrel. In addition, any teacher can use this same type of access and appropriate amplification equipment to enrich group experiences.

In the future the system will provide a number of additional capabilities:

1. A random access video phase to complement the audio.
2. Fifty additional carrels to bring the total to seventy-five.
3. Tying-in of 200 classrooms in the high school and surrounding elementary districts.

CHAPTER VIII

INTERVIEWS WITH THE EDP INFORMATION SPECIALISTS

A new breed of specialist is emerging in education. He is the EDP information person. The position is so new that reference to it is hard to find in any one of the current textbooks on school administration. It is a specialty derived from two sources: the electronic computer and the information explosion permeating education and most other areas of human endeavor. At present there is little basis for the position. In the beginning, the preponderance of specialists had to come from fields other than education. In many instances their lack of educational experience created a great deal of confusion and numerous problems. In recent years educators have become interested in this field. Many educators who acquired a background in EDP are now making significant contributions.

A challenge to education is the EDP industry's burgeoning need for trained personnel. This shortage, long ago, reached critical proportions. Many colleges and high schools are now preparing students for the field.

This chapter will report interviews that were conducted with persons in the field in order to elicit their knowledge and opinions. This will give the study a greater depth than might otherwise be possible. These interviews were not confined to persons working in education but encompassed representatives of EDP equipment manufacturers as well.

A. Lawrence Rosenthal
Chicago Board of Education

The EDP Department of the Chicago Board of Education has recently undergone an administrative restructuring. Its status as a bureau has been changed to that of a department with an assistant superintendent at its head. Its level has been elevated to the same status occupied by other departments such as curriculum, vocational education, pupil personnel, and federal programs. Presently, Mr. Rosenthal's superior, the head of the department reports directly to the Superintendent; eventually he will report to the Deputy Superintendent in charge of the day-to-day administration of the school system. The Superintendent's time, under this arrangement and in conjunction with a staff, will be spent in high-level planning.

The new head of EDP, Harry Strasburg, rose through the ranks as a teacher, principal, district superintendent, and now assistant superintendent. More important than his knowledge of EDP is his background in education and his ability to solve the problems inherent in the school system.

The Chicago public schools long ago recognized the need for EDP training of its personnel. A few years ago, when it operated a number of junior and senior colleges, the Board pioneered a complete curriculum of EDP education. The Education division of the EDP Department presently engages in three general areas: in-service training for the school's administrative and clerical staffs, a field staff whose function it is to coordinate EDP in the schools, and a curriculum development program aimed at the high school student. This will soon be expanded to include introductory courses in EDP for anyone who wants to

learn about the field.

In the past all equipment had usually been rented from the IBM company. A transition is now taking place from second to third generation computers, which will result in a quarter of a million dollar saving per year over the cost of the present equipment.

The biggest problem in the Department's operation is the retention of trained personnel. The wage structure in education does not allow it to compete with private industry and, in many instances, education finds itself unable to do so even with other local governments. For example, the City of Chicago has personnel who do the same work but have different titles, resulting in higher salaries.

The Board has long been committed to a "total information" service. Each plan or change in its operation is predicated on this concept. By no means has there been complete implementation of the idea, nor is there any indication that it will be in the near future.

Mr. Rosenthal sees cooperative arrangements between school districts as an ideal worthy of attainment, but he is not familiar with any successful applications. Many schools talk about the program but little is done. Unless the statutory requirements are similar, there are problems of great magnitude.

The Chicago Board of Education is presently not doing anything in simulation but will do so as soon as possible. Their big push is the conversion of their second generation computers to third generation computers. When this is completed, work will be started on a Planned Program Budgeting System (PPBS), a software system that uses the past financial factors and projects' cost-estimates for determining the nature of future programs.

Rosenthal sees Computer Assisted Instruction (CAI) in the future as a common place activity. He also sees the use of simulation in the planning of school facilities as an important concept. Chicago has a commitment to the idea of "magnet" schools, and the proper planning and implementation of these will not be possible without simulation.

B. Cecil Badner
New Trier High School

The EDP installation at New Trier High School is under the direction of Cecil Badner. He, in turn, is responsible to the business manager of the school.

Mr. Badner came into the school system with a background other than education. In his opinion an education background is not essential to the task because one could well have been exposed to enough of education requirements to give him a background if he has gone to college.

In-service education would be a nice thing to have but its limited start makes it unfeasible for New Trier. This will continue to be a problem until enough persons come into the schools who have been exposed to EDP in the high schools as students are now doing in New Trier. This will result in a higher level of sophistication at all professional levels.

There is no point in purchasing EDP equipment. IBM's large discount off of commercial rates for educators and unlimited time usage makes leasing an attractive arrangement. Commercial consumers are charged the full price and, in addition, are charged on the basis of time.

IBM seems to be the only one with this liberal pricing policy for

educational institutions. However, since the advent of third generation equipment, some other manufacturer's equipment capacity has made them competitive with IBM's discounted second generation apparatus.

Leasing of computer time at another location is a relevant consideration. Some institutions may never need their own equipment. The Evanston Elementary School District had originally planned on their own facilities but found, in the process of implementation and establishment of procedures, that the use of the high school equipment a more economical approach. Another advantage to a remote location is the separation of the programming staff from the machines.

Hiring and retention of staff is a big problem. The advent of third generation equipment requires an upgrading of skills. The nature of the art attracts inquisitive persons eager for self-improvement. Once the problems are solved at one location and the challenges overcome, the individual must move on to other worlds.

A cooperative arrangement with the Wilmette Public Schools is in the offing for New Trier. This should prove profitable for both sides in that it could result in an enlarged department with the ability to hire more minds to solve the problems. The result would be a more professional department.

The Assistant Principal's office is the source of communication from the EDP Department. So far, and for a number of reasons, this has precluded much written communication from EDP to the school staff. EDP responsibilities are under the direct jurisdiction of the Business Manager, but, having many other duties, he has left Badner in charge -- nominally, but not officially.

A "total information" system and simulation techniques are seen as being desirable but really not available to small schools. Their utilization

requires a high level of sophistication. There are too many day-to-day problems that have to be solved in a fragmentary manner leaving little time for one to be concerned with overall planning.

CAI is probably the biggest wave of the future. It has great relevance for the teacher in the enhancement of the learning situation. For the EDP person it will provide larger, more sophisticated equipment that, otherwise, might not be justified.

C. William Reed
Township High School District 214

William Reed is Director of EDP for the six schools that make up Township District 214 with central administrative offices located in Mount Prospect, Illinois. The Director's position is not well-defined on the organizational chart but, as presently constituted, it is directly under the Superintendent. An experienced teacher, Mr. Reed also occupied a counseling position for five years before assuming his present duties.

Mr. Reed's primary function is to know enough about the machine to be able to draw-out information from educators and coordinate this with his EDP knowledge. This would have been impossible without his educational background. He says:

> If you're going to work only in business office applications, educational background isn't too important, but with student accounting and other uniquely educational applications an educational background is required.

Two in-service courses are offered by the EDP Department. Fortran programming is taught for the benefit of mathematics teachers, and an introductory course in EDP is conducted for members of the staff who want to avail

themselves of it. There have been requests for a continuing course but one is not presently contemplated.

EDP personnel in education are extremely difficult to obtain and cannot be kept once hired. Capable people can get more money elsewhere. Another factor contributing to this problem is the opportunity for personal growth that exists in government and in business. People lacking a degree and teaching experience cannot move into administrative positions in education.

The EDP situation at District 214 could be used as a model for educators interested in cooperative endeavors. The EDP Department, serving six separate high schools, contemplates a functioning arrangement with a local elementary school district as well as Harper Junior College.

A "total information" service is an eventual goal but is not expected to become a reality for several years. There is a need to develop the present operations to their fullest extent and then to integrate them. The process is also one of integration on the part of the school staff and EDP procedures.

Exception reporting is done on a limited basis. One of these is checking classes for size, i.e., limitations in enrollment may result in certain classes having fifteen or fewer students in a room built for thirty-five. This type of exception will be brought to the attention of the appropriate administrator for special handling. Enrollment in the district is calculated on a number of other bases: by subject, sub-department, and department, complete with a grade analysis. Over and under utilization of the staff will show up in these kinds of analyses and will, in turn, show up as cases of exceptionality.

Communications are not of a regular nature. Written instructions are sent out whenever processing of particular records requires teachers' assistance.

These are made as specific as is possible in order that they can be easily understood and interpreted. They would include what has to be done and when it is due.

Simulation is not yet a feasible task. A number of factors preclude its use in the near future; all of the necessary information is not available and neither is personnel who can devote their time to development of the programs. In order to implement simulation, it is necessary to develop a model of the school. Manipulation of this model with the aid of the computer would indicate the effect that budget or other changes would have.

Education is seen as being about ten or fifteen years behind business in computer usage. There are many things in industry that can be adapted to educational programs. It is necessary for educators to get over their attitude that education is so much different than other areas of life. The efficiency of education, both administrative and instructional, is going to have to be improved. A step in this direction is the up-dating of education's ability to evaluate its techniques and methods. The need for teachers could become so great that it would not be possible to hire enough teachers. CAI and other technological innovations would be required to fill this gap and provide the necessary instruction.

EDP manufacturers are going to have to supply the schools with hardware and other aids at greatly reduced costs if the schools are going to educate the labor force that will be required to handle the computer-oriented society of the near future.

D. George Stangor
Evanston Township High School

The Director of Data Processing at Evanston Township High School is, presently, a loosely structured position, sometimes reporting directly to the Superintendent and other times to the Assistant Superintendent.

George Stangor, the Director, came to Evanston from a guidance position in another high school. He has a comprehensive background as an educator and feels that placement of EDP in the business office is a big mistake. Business is probably the least important aspect of education. EDP's most important function is to serve the school. Mr. Stangor states:

> Give me a school person and let me teach him EDP. I can understand the problems of the teacher. Those who aren't educators can't understand the problems of the teacher. Schools don't operate as businesses do.

In-service education for the school staff is tremendously important. Evanston has not begun a program as yet but expects to have one underway soon for the counseling staff. If people are taught enough about EDP, they will be able to ask intelligent questions. This, in turn, can lead to thinking in terms of new applications.

The purchase of a computer is seen as an exorbitant investment with little justification, particularly since it becomes obsolete so quickly. Certain peripheral equipment can be bought such as keypunches and sorting mechanisms. Both are a good investment because they cause little trouble and seldom change.

Retention of personnel at Evanston is good. The women whom he has appear to want to stay because of certain little benefits offered. The programmer seems content because he gets an excellent salary.

The elementary school district has a cooperative arrangement with the high school with the latter taking care of the machine operations. For a while the elementary schools planned to get their own EDP equipment, but, decided it was not economical and discarded the idea.

Faculty meetings are the only means by which the EDP Department communicates with the staff of the school; there are no written materials as yet. This is not regarded as a desirable approach but plans are presently afoot for implementing an improved procedure.

As the system progresses, it is designed on a unified basis not as a piecemeal task. All additions are made to it with consideration for this concept. There is a distinctly "total" plan set-up. It is possible that all information has not been obtained as yet, but if and when it has been collected, the system will not have to be reorganized in order to meet the requirements of the new material.

Little need is presently seen for the use of simulation although a consulting firm was hired a couple of years ago to build a master schedule using Massachusett's Institute of Technology's GASP program.

All processing is done with built-in exception provisions. The payroll is set up at the beginning of the year so that an individual's pay is always the same except for those items that require a change. In the attendance procedure everyone is regarded as being present except when someone is absent. Budget accounting, however, is not done by exception. It is reported on a regular monthly basis.

Cooperative ownership of centrally located computers in each school feeding off of it is seen as the wave of the future.

E. Norman Weinberg
Lyons Township High School

The Director of EDP of Lyons Township High School, Norman Weinberg, occupies a staff level position that in effect "floats". He is directly responsible only to the Superintendent, but he works closely with the Business Manager and an assistant principal. It is important that the position cuts across all disciplines and that it be independent of all other departments.

Weinberg came from a business background prior to his venture into data processing. Before coming to Lyons about three years ago, he spent a number of years working in the EDP field at the Chicago Board of Education. At present he is completing an MBA at the University of Chicago. He feels this is very important in his work. He sees little purpose in a professional education background and never intends acquiring any himself.

No in-service education has been available to the staff up to this time, although some afternoon sessions are scheduled for next year. For the EDP staff, it is a catch-as-catch-can situation. Weinberg has only enough personnel available to discharge the day-to-day responsibilities of his department and cannot find time to write-up the EDP procedures in a proper form. This is excusable in a small installation, but in a larger one things would have to be formalized.

Mr. Weinberg feels that EDP managers should have some background in school systems. If it were a choice of one or the other, a computer business background would be preferable; the school background can be acquired. A certain amount of transfer exists from industry problems to school problems.

Weinberg feels that he can take a new job and complete it a lot faster than people who do not know the machines as well.

The personnel situation at Lyons is characterized as "lucky" inasmuch as the director's assistant, who started at the same time, is still on the job. There is great reliance on part-time junior college personnel. For security reasons these are carefully selected in order to exclude former Lyons students.

Lyons is now doing all of Riverside High School's EDP work except for the student scheduling. In order to accomplish this, it was necessary that Riverside have their card format system converted to conform to the Lyons situation. All Riverside records are now maintained by Lyons.

With the impending delivery of their new NCR200, a third generation system, preparations are being made for building a comprehensive data base with an approach to a "total information" system. From this it is hoped to extract anything that will be needed. It will be a disk oriented system with a four year record of each student, that should furnish a lot of data for longitudinal studies that anyone wants to make.

A great deal of exception reporting is done; failure lists, absence reports, absence lists, etc. Before anything else is done with the grade cards, a list of failures, incompletes, and special education reports are printed-out. EDP has little use in budgetary problems, and no exception is done on budget.

Weinberg sees the future as becoming increasingly complex with concommitantly better instruments for the enhancement of the learning situation for the individual child. An important device that can help in this area would be one that would allow the identification of those students whose

achievements are a long way from matching their capabilities.

F. Norman Mitman
Northeastern Illinois State College

EDP at Northeastern is under the direction of Norman Mitman, the Director of Computer Services. He reports to the Vice President of Administrative Affairs, who, in turn, is responsible to the President of the College. Mr. Mitman is a professional educator having served as a mathematics teacher. He still functions in that capacity when needed. He sees a need for an education background as being dependent on the nature of the application: where it is used only for business office applications, there would be no need; where educational applications are involved, an educational background is desirable. Seen as a problem is the emergence of the school business manager from the academic area.

Northeastern has no in-service training program presently underway. One was contemplated recently, but the necessary funds were diverted to other programs. The college curriculum at one time did offer a number of EDP courses both introductory and of a programming nature.

The IBM360-30 computer that was installed recently is on a leased basis as was its predecessor, an IBM1620. The most important factors in leasing are those of maintenance and of obsolescence. The previous unit had only been installed for about seven years but had long been obsolete.

Installation of the 360 required that three new people be hired. Finding qualified personnel was difficult so two were employed only with a basic background. Retention, so far, has not presented a big problem, although

Mitman understands that mobility is high in the field.

Some plans for overall systems cooperation between state universities shows some future promise. This could be successful if it were undertaken by persons working in common for different institutions rather than having the individual institutions assume the task. Another state-wide possibility that has considerable merit is a system using one large machine operating on a real-time basis with the individual institutions hooked in by cable.

Written communication is of a minimal nature. Some widely applicable procedures are written-up in a brochure form and mimeographed. Most services are to administration, and a special department in the school's business office handles their own tasks. Fortran will be more readily available to the staff when the new equipment is fully operative, but even then it is contemplated that communications will continue mostly by word of mouth.

A "total" system is under development but is hardly off the ground. The preliminary work of getting the various departments to cooperate is under way.

All reporting is of a periodic nature within a prescribed format. No provision is made or contemplated for situations of exceptionality.

Mr. Mitman sees real-time use of computers as having the greatest impact in the future. Remote terminals will be used in ever-increasing numbers; they have not been exploited to the extent that they should be because the economics have not been well planned as yet.

G. Walter Corvine
Chicago State College

Chicago State's Computer Centre is headed by Walter Corvine, a long time

teacher, guidance counselor, and administrator in education. He reports to the Dean of Administration, who reports to the Executive Vice President, who, in turn, reports to the President of the College.

Corvine finds this system unwieldy. The biggest complaint is his inability to elicit policy decisions:

> Educators find it difficult to make them. The computer has forced people into a corner where they have to do things they're unable to do. Records can't be up-dated on a 'perhaps' basis. He adds . . . computer centers will some day end up running the school because they'll have to make the decisions that administrators won't make.

A professional education background is seen as absolutely necessary. Unless an individual has worked in the school, he would be in no position to understand the complexities of the situation.

Chicago State, presently, has no in-service education and none is contemplated. Corvine feels that schools that are offering it are only giving lip service to the concept. He does feel that eventually all administrators must have significant courses in EDP as part of their college preparation.

Hiring of EDP personnel is an overwhelming problem. Chicago State has not been able to get any experienced people. "Schools don't pay enough." EDP salaries are locked-in with a civil service scale and cannot pay people what they are worth. More money is the only solution.

A "total information" service is the ultimate goal of Chicago State's system. With that end in view as each sub-system is designed, it is carefully planned as an interrelated part of the whole. Equipment, as it is incorporated

is done on the basis that it will contribute to the "total" concept.

A procedure manual is published by the department to acquaint the college staff with all of the services offered.

Corvine sees value in the use of simulation and would do so if he had any idea of what could be done. He is not aware of anyone else who has any ideas either.

Reporting at Chicago State is mainly on an exception basis: students are reported out who do not fit into the general pattern of things, expenditures in accounting systems are treated in the same manner if they are over and above the normal operation or are not consistent with past patterns.

H. Charles Thomas
University of Illinois, Urbana

Charles Thomas is the Assistant Director of Administrative Data Processing at the University of Illinois, Urbana. His superior, the Director, reports directly to the top administrators of the University. His educational background is in management and economics. He came to the University as a student over ten years ago and, as a result of his interests, stayed on after graduation.

The large scale system at Illinois requires personnel who are technologically sophisticated, and who are good at problem-solving and stubborn enough to stay with tasks which seem insolvable to others.

Obtaining money for EDP use is not a difficult task at Illinois. Money is being spent to keep books are rarely is it difficult to justify increased EDP programs on the basis of costs. Additional substantiation is always

possible in terms of a costs vs. benefits theory, and the benefit is quite often not in cash. Someone has to say, "Yes, the benefits are worth the cost," before they develop the system.

The department offers a course in EDP for University administrators, most of whom have been exposed to it. Courses are also given for EDP personnel. If an individual comes in as an analyst, he has to become a programmer for six months. A system cannot be designed by an individual who does not have the knowledge to program a computer. In point of fact, few come in without some programming background. However, programming is becoming the least important part of the data processing problem. The biggest concern now is with the system's design. This has been made possible as a result of the advent of the simplified programming language, COBOL.

An important thrust of the department is the development of their Management Information System, a total information service. This will operate as a superstructure over the many batch processing systems and will be capable of performing the functions of collection, maintenance, and reporting for any file in the system. As a result of this approach, all files will operate as segments of a large data base. A management data base will evolve out of this and will operate on the premise that 100% of all questions can be answered by analysis of 100% of the data, whereas 90% can be answered by analysis of 10% of the data. It is indicated that the latter approach, in most instances, is the most feasible. Graduate students are presently working on determining what the relevant data are.

In the area of educational information the lowest common denominator of institutional analysis is one student meeting with one instructor for one

course in a classroom for a specific length of time and a specified amount of credit. This basic approach can be used in any number of ways: what is the average class size? what is the average instructor's load by department, college, or subject area?

All of the relevant elements now exist in separate files: in the Payroll File by instructor, in the Students' Records for the student, in the Timetable file for the rooms. To analyze the information it is necessary to dip into five separate systems to pull the data together. Pulling them together for management presents somewhat of a problem because they are not designed to be brought together. Activity in the last few years has been directed towards having them mesh and have each individual system become a sub-system in the overall system.

The real goal of the Management Information System is to enhance decision making for the University. For example, the Provost can easily pull out data and simulate operations of the institution for five years and look at the results.

All sorts of "What if?" questions can be asked by changing the elements and seeing what the results will be. A multitude of interrelationships can be established and the results ascertained, The data are always available, although it may or may not always be organized for efficient use. The question is: where is it, who has it, can they use it, and does it get to the right people at the right time?

I. Gordon Frazier
Chicago City College

Chicago City College is a group of eight junior colleges strategically located around the City of Chicago. Gordon Frazier is the Director of Data Processing for the entire system.

In order that an EDP facility effectively discharge its responsibilities, its top administrator must be at a level adjacent to the top of the organization chart. The opinion of many persons in the field is that most companies will have vice presidents of information who will be computer-oriented. This is a trend which will also carry over into education. Mr. Frazier states:

> The feeling is that information is as important an asset as your bank account. Your bank account itself is information.

The EDP Department has made extensive entry into in-service education. It has provided for their own people, for instructional staff engaged in EDP education, and for staff members interfacing with the computer. The latter find themselves in a predicament where they do not have up-to-date information about the EDP field. The only people who really have this are the active practicioners who fall into three categories: those who are programming, systems people interfacing with the real world, and managerial people. All of these seem to have information of various sorts that is not available to people who are just outside of a certain sphere. It has been found necessary to try and upgrade the quantity, quality, and timeliness of information that these people possess. It can be said that until they have this kind of exposure they are not going to be able to face the voluminous information in the EDP field. In-service education is an ongoing successful project and people are enthusiastic about it. The presentations are being made at a level that does not confuse them with terminology. The main objective is to have them leave

with the confidence to approach the literature.

The hiring and retention of personnel is a serious problem that is compounded by poor salary structures. Statistical reports indicate shortages ranging from fifty to one hundred thousand throughout the country depending upon who is reporting. This is acute when one considers that there are only about ten thousand installations. If there were more people, the chances are that there would be more installations. The salary schedule, as related to traditional disciplines, has been forced up to levels that many people feel are unrealistic in terms of training and background required to discharge the responsibilities. But the law of supply and demand forces it up without respect to traditional disciplines. Either pay the price or resort to traditional disciplines--the quill pen.

The term "total information" is just a term and has no basis in reality. A lot of people are talking about it but no one is doing it. There are people who are approaching the concept as an ideal. What is really meant is something far less than what is claimed. An attempt is made to gather all the information necessary to run the college and put it in a data bank located in a random access device. This gives one the ability to interact with the information and is probably the ultimate objective of every installation.

Frazier sees simulation as the means whereby the real world is equated with an algorithm within a computer, thereby saving a lot of time and expense. Through analysis one can extract certain pertinent characteristics of the real world and quantify them. These are then placed in the computer in the manner of a system that imitates the real world. From this interaction results are obtained for many conceivable sets of circumstances. From these results a

decision is made by the responsible individual.

Massachusetts Institute of Technology has devised an academic administrative simulator GASP. This shows some promise for predicting the requirements of a proposed educational structure. If a new campus were being built, the determination of numbers of class rooms and faculty members, could be predicted to optimally operate the institution with all the other aspects required.

Management games are available to administration for practicing the operation of an academic organization without using the actual resources. Through their use a great number of mistakes that would result from faculty decisions can be made without costing the taxpayers money.

Exception reporting can be a "bucking of tradition." It is an important concept in business but not in education. When many men have reached a certain age, they have become accustomed to certain traditions. Many require reports in volume and anything less is unsatisfactory. The frustrated administrator has a technique available to him that would provide him with the kinds of synthesized information that he needs to devote his time to, but he is not quite ready for it. People spend large amounts of time pondering voluminous reports that were essentially the same when they looked at them last month. EDP people would welcome exception reporting because it cuts down on the paperwork that they have to produce.

Frazier would like to see EDP stand still for a while. He has been in the field a long time and is tiring of the discipline. The process of trying to keep up is overwhelming. In no other field, except perhaps medicine, is there this volume of things going on and "the rewards aren't that great."

J. Phillip Grise
IBM Corporation

Mr. Grise, Marketing Representative, Colleges and Universities of the International Business Machine Corporation (IBM), was interviewed concerning the manner in which his company was contributing to the requirements of educational information. The term IBM and computers, in many person's minds are synonymous. This is not without good reason; the company dominates the field to an extent heretofore unknown in American industry.

IBM has done a service to educational institutions by organizing along industry specialization lines. The office in which this interview was conducted is termed GEM, the Government, Education, and Medical office. It was started about three years ago, and Grise has been a part of it since its inception. His field lies in administrative uses of the computer as the basis of a Management Information System (MIS). He has no concern for research or student-academic applications.

A few years ago IBM got caught up in the prevailing rush to develop a "total" service. Its system, termed UCIS (University and College Information System) was studied for two years but subsequently dropped. It seems that development of a universal system applicable to a large number of installations was an impossible task. No two colleges in the country can agree on a way of doing anything. Furthermore, it seems there are no two departments within a college that can agree. Alumni, personnel, records, etc. should not be required to conform to parameters devised by someone else.

The proper approach is to have each institution establish a system group

that will find out what each department wants, and plan on this basis. Put these individual sub-systems together and that becomes the information system for that institution. A compromise situation would see the computer manufacturer writing the control program, the monitors, and many of the data file management techniques. This would leave the customer writing his own specialized payroll, admissions, alumni, and other routines. Collectively, this would be the MIS. The technical aspect would be done by the vendor and the detailed portion by the institution.

The UCIS approach did serve a useful purpose; it took the good ideas of manufacturing and government information systems, ideas that did work and things that were being used in private sectors of the economy, and brought them into view of the colleges. Many colleges realized the value of the concept and embarked on their own project. At this time no college as yet has achieved a completely integrated college information system.

Some small institutions are presently involved in an unnecessary and expensive concern for third generation equipment when second generation would be more than sufficient and certainly more efficient. The value of the IBM350, a third generation device, is discovered in things like teleprocessing, being able to tie in with things like the library, personnel, admissions, records, ets. The IBM1401, a second generation device, is the way that the education field is going and will be going for a long time. Many institutions that have computers use them in a mundane and non-creative manner that could just as well be done on unit record equipment.

Grise disagrees with AASA's recommendation that one should not be concerned with second generation equipment but, instead, go right into third

generation. The institution that has a 1401 should continue with it because the really sophisticated peripheral equipment that makes the 360 worthwhile is three or four years from development.

Grise cautions against the effort duplication that exists in most institutions. If a basis of identification of people in the files is properly established, this might as well be the last time needed to enter them. He recommends a social security number as the proper reference. This will serve as valuable economical identification from the time the student is talking about entering school, right through his tenure as a twenty-five year plus alumnus.

Under a "total" system all pertinent test information and grades can be subjected to analysis that will predict a student's grade point average at the end of the freshman year. This can be done with frightening regularity for the end of each year. This first interface occurs in the admissions department. From this he is given over to the registrar who, in turn, picks up additional information from an application. All departments work with the same data in the computer; it is just transferred around from one file to another. The Dean and Bursar also pick him up, the former for counseling, the latter for fees. Upon graduation, the information is floated over into the alumni file. What is not needed is lopped off onto hard-copy (typewritten) and saved for later use.

Administrative costs of an institution can be greatly reduced by the standardization that results from a common data base and everyone accessing the same information. The University of California at Irvine was constructed

with its computer in the geographic center, eliminating many secretaries, clerks, and record people. The computer keeps the student's records and has taken over the faculty job of storing test results.

It is important that the individual who controls the computer report directly to the top echelon. In the business world this is an axiom. In educational institutions the unsuccessful applications are quickly identified; they are headed up by someone reporting to the business manager.

Low cost remote terminals give evidence of having the most impact on the future of education. They are not low cost today -- $70 to $100 monthly rental. Hopefully, this rental might be brought into the $10 to $20 price range. The greatest impetus for this has come from the experiments in CAI. Schools will have computer laboratories as they now have language laboratories. Students will use it as a high-speed calculating machine for solutions of science and mathematics problems and for laboratory simulation, dictionary, library, and a myriad of tasks. This will come about through the partitioning of the inside of the computer for doing different things at the same time: message switching, payroll, student jobs, etc.

Collections of schools could use a central computer as an administrative device. All would run their own programs at the same time with none being aware that the computer is not totally dedicated to them.

Buying or renting a computer seems to be a consideration of specific type of use. Where the machine is being used for research, there is a growing tendency to purchase. Where the uses are administrative, the trend to lease continues. Little basis appears to exist for this phenomenon beyond the

unique circumstances that exist in each institution.

Cooperative arrangements among institutions are good but do not have great popularity unless a common denominator exists with strong administrative control. A church affiliation would be a good example. Seventeen small colleges in the midwest have banded together on a cooperative admissions service. This is a selective application and would, probably, never be extended to cover other activities. The way things are now, running a separate program for each organization would fail to solve any problems. The IBM Company tends to benefit from cooperative arrangements because usage on the machines is built up to the extent that the total is greater than would have prevailed were they operated singly.

In Grise's opinion the ultimate of cooperation would consist of geographically separated schools having various aspects of their institution combined by computers. For example, one school does not have a certain book in its library, the computer would search another school's library. In this same manner they could share a music library.

K. Larry Rex and Richard Sabie
Honeywell Inc.

Larry Rex and Richard Sabie are Education Supervisors for the Honeywell Corporation, one of the country's leading electronic and computer manufacturers. In their opinion the largest problem in education is student scheduling. They have an excellent program written for their hardware by Lewis College of Joliet and given to Honeywell for distribution.

Honeywell is quite proud of their MERS (Marketing, Education, and

Research Study) program written for the use of their own education centers. MERS is written in COBOL and is intended to keep a complete record of each student who has attended one of their schools. An important aspect of the program is the exception reporting that is done whenever a student's skills need updating in some area; in six months an individual in the field can get far behind and in twelve he can become antedated. For the customer it produces grade reports, certificates of completion, and information as to what additional classes will be required. It also schedules classes for the center and makes a determination of the customer's interests. The program is used internally but is available to companies that might have a need for it.

Educators could put a similar program to work gauging educational needs. They can base their utilization of facilities and course offerings on trends predicted by the computer. As some field gives indication of assuming increasing significance, they can direct their energies to that area. Mr. Sabie states:

> Before, most colleges would say, "This is going to be THE area," yet nobody showed up for the school. They're catching up very rapidly. They were always guessing wrong. They're sensing the the changes and what people are looking for.

Honeywell has developed a new concept in computers. It is a combination word and character oriented device operating as two computers in one and sharing a common memory. It is termed the Model 8200. The word computer is capable of running up to eight programs independently and simultaneously, with the character mode processor handling much of the input and output functions.

A concept termed "interleaved memory" prevails here and allows more than one memory cycling at any one instant in time. It is possible to have eight

stacks of memory cycling simultaneously. The unit operates at a transfer rate from peripheral memory of 2.8 million characters per second with computing still going on. The internal speed of memory is 750 nanoseconds per eight character word. Included in the new unit is an electrically alterable "read-only" memory. This replaces much of what used to be the Control Unit logic of the system itself. It is basically pre-programmed hardware that is part of the active central processor.

The 8200 also has three different types of memory: main, read-only, and control. The main is the ordinary ferrite magnetic core. The read-only is a unique device that allows changes in the content to be made in the field by changing impulses in it and making it do whatever one wants. It can be made to perform like a Burroughs, a CDC, or an IBM machine. What it does is to negate the necessity of rewriting the software from one machine to another. It is pre-programmed with punched paper tape. Control memory is made up of integrated circuits with a read-out cycle time of 125 nanoseconds. A future possibility is screen-door memory to increase capacity. These are thin plated wires running perpendicular to one another, and where they cross, they are capable of storing a binary bit of information. This is much cheaper than the hand-formed ferrite cores.

Pre-programmed hardware that spares the customer the expense of this task will appear in the near future. Honeywell has coined a word for this, firmware, it is not hardware and it is not software. This does not bode well for programmers. A machine could be built with eight or ten read-only memories, and all that would be needed then would be systems people to design the input

and output.

Simulation holds great promise for increased efficiency as it concerns every aspect of education. Some typical problems that might be put to an analysis are concerned with: curriculum planning, teaching complement, physical facilities' construction and maintenance, laboratory facilities and materials, and transportation. It gives the administrator a chance to take all factors into consideration and, hopefully, point out the eventualities necessary to make a decision. One would be limited only by the vividness of one's imagination.

The term "total information" is an anathema to Sabie. He feels that the idea has been "beaten to death." The MIS concept by exception reporting is taking its place. The biggest problem is trying to get management involved, getting it to understand that the computer is not a great horror but a wonderful tool.

L. Thomas England
Control Data Corporation

Control Data Corporation (CDC) is an unique American industrial concern. It has only been in existence for about ten years but is considered an outstanding leader in the field. IBM is a much larger organization but quite often has to take a back seat to CDC where new technology is concerned.

Thomas England is employed by CDC as a systems analyst for pre-sales and post-sales work in charge of its Model 6000 system activities. It is his responsibility to provide assistance to the salesman until equipment is selected and on-site. He also functions in a support capacity as new software

becomes available. He is not concerned with the maintenance or design of the hardware, only with knowing about it from an external standpoint.

Hardware people are a part of marketing. Marketing comprises essentially three parts: sales force, applications analysis, and customer engineers (hardware maintenance).

CDC Data Centers (service bureaus) are located throughout the United States with large 6600 machines located in Los Angeles, Houston, New York, and Minneapolis. The branch offices have small computers which are connected by telephone lines to the main computers which do the bulk of the work.

The CDC6000 line of computers was the first third generation equipment on the market when it was introduced in 1964. It is the largest machine on the market today. The central processor of the 6600 unit is made up of ten functional units with a choice of three memory sizes: 32, 65, or 131 thousand sixty bit words. These functional units can all execute instructions simultaneously, and because their operations are parallel in nature, very high speeds are achieved. This also allows an instruction to be executed prior to a previously issued instruction. The machine is capable of issuing four million instructions per second.

Another feature of the unit is the ten peripheral processors (PP). Each of these are separate computers in their own right, with each containing 4,000 twelve bit words. The peripheral processors provide multi-programming capability for the 6000 unit. They do all of the input/output (I/O) work. The central processor has no I/O instructions within it. Information is passed via PP memory into central memory where it can be located in any one of sixteen

separate banks of memory, and where it is possible for continuous words to be in separate banks. The machines have a scientific orientation but will operate, though not as efficiently, in business applications. The reverse applies to business oriented machines.

Northwestern University's Vogelbach Computing Center is an example of the research and education service that can be provided by the 6000 computer. Programs for the computer are usually in Fortran and are the result of combined efforts of the staff and students. Some software packages are available from CDC and some from the CDC users group, a cooperative software-sharing organization. With sixty Model 6600 units in operation a large number of programming applications are generated.

Benjamin Mitman, Director of the Vogelbach Center, is starting some projects using INFO, a software package designed to retrieve information from large files. He wants to extend the concept to operate on a real-time basis so that a person seated at a teletype or a CRT can interact and retrieve information immediately. This will be done without interfering with the normal computer operation.

CDC currently has a Teletype Respond software package available. It manipulates, constructs, edits, and submits files for execution. The job will be executed in the normal job stream and the file retrieved back to the originating teletype unit. Another package, termed Export-Import, is used where a remote batch is submitted. A new software package is designed to be used with Model 200 user's terminals. These have a CRT device along with a typewriter, a printer, a card-reader, and a punch. It can be used in a respond-type

application instead of a teletype arrangement.

A new development just getting into the field is called Extended Core Storage (ECS), with an access memory of up to two million sixty bit words. They come in modules of 131, 256, or 512 thousand words. One cannot execute instructions from it, but it can be accessed in three micro-seconds. The transfer rate is ten megacycles, ten sixty bit words every micro-second. Taking a 120 kilocycle tape drive means that the tape can be read at the rate of 120,000 characters per second.

With this ECS capacity, time-sharing is going to be vastly improved. The CDC operating systems will be based on ECS and will enable many users to access the computer, which, in turn, can time-slice or roll entire programs in and out of ECS without interfering with one another. ECS will be the basis for CDC's operating systems for some time to come. It has not been announced yet, but CDC is building a Model 7600 which has four or five times the capacity of the 6600.

Future machines will have ECS built-in and will be called large core. The speed of getting in and out of ECS is dependent upon and faster than main memory. Although the ECS has less storage than disk, the latter's access time is much slower.

Mr. England is presently engaged in a pre-sales effort in conjunction with the University of Illinois' Plato, a CAI laboratory. The Plato effort presently is based on an old CDC1604 computer using twenty CRT units. With today's technology it is possible to operate 4,000 CRT units with a given computer. The new type of visual display unit under development is a radical

departure from the CRT with an electron beam orientation; it will use a plasma substance and requires very little physical depth.

Illinois is interested in purchasing the biggest computer available. CDC is recommending their Model 6600 in a time-slice arrangement. The University will develop its own programs with an eventual goal of 4,000 remote terminals, primarily for CAI. An important feature of the system will be fast data-switching, executing about four million instructions a second.

Mr. England made some interesting miscellaneous comments:

Most universities purchase their EDP equipment.
Leasing is getting bigger and bigger.
CDC is trying to become more diversified, application-wise.
CDC and IBM are the only ones making money.
CDC and Burroughs are the only ones advancing the art.

M. Bert Watson
Burroughs Corporation

The Burroughs Corporation with its associated companies is a long-time American business equipment manufacturer as well as one of the leaders in the field of computer research and development.

The company is presently immersed in the future, probably to a greater extent than is any other. Last year the Defense Department's Advanced Research Projects Agency awarded Burroughs a contract to develop Illiac IV in conjunction with the University of Illinois.

Illiac IV is a fourth generation digital computer. When this writer visited the Digital Computer Laboratory at the University of Illinois, it was explained to him that, upon completion, Illiac IV would double the computing

capacity of the world.

Fourth generation equipment is made possible by a concept characterized as large scale integration (LSI). A fourth generation electronic circuit is about one tenth of an inch square and holds about 100 complete electronic circuits. Modern computer technology has become so intricate and the speed of calculation so rapid, (Illiac IV will do one billion calculations a second) that great concern must be evidenced for the spacing of components. Engineers now deal in light-foot quantities, the distance that light travels in one billionth of a second. This will allow the fourth generation to operate at speeds 500 times faster than the third generation.

The original intent of the Defense Department was to have this technology as the heart of a missile defense system. A problem here is separating the real warheads from the decoys. It is expected that the Illiac IV will provide the necessary computation speed.

Watson sees multi-programming in conjunction with a large data base in a "total information" type of system as the wave of the future. New equipment that Burroughs is starting to deliver is capable of accomplishing this task at a relatively low rental. Their requirement for multi-programming capabilities is only 13,000 bytes of core, whereas other manufacturers require about 100,000. A head-per-track capability (eliminating moving heads) in their disk pack units has reduced the accessibility to twenty milliseconds. This allows the Burrough's computer to store information on the disk pack that other manufacturers must store in the core, resulting in larger machines.

One of the biggest computer orders in history has recently been received

by Burroughs. The U.S. Air Force ordered 135 B3500 systems to be installed in air bases around the country for the managing of logistics at the base level.

The State of Illinois uses a B3500 to keep track of all driver's licenses and license plate identification information. In 1969 Illinois plans to use a B6500 unit which the Secretary of State has indicated will save $13 million annually in clerical costs and will provide information on five million motor vehicle license applications as well as facilitate the collection of parking violations by providing registration information.

The State of Michigan has a Law Enforcement Information Network (LEIN) using a B5500 unit. Connected to this are teletypewriters at state police posts, police departments, and sheriff's offices throughout the state. The capacity is 500,000 warrants and 20,000 wanted records with the capability of larger expansion. The entire file of 350,000 fingerprints in East Lansing when fed to the computer can be searched in seven minutes.

The home office of Burroughs has "total information" plans but presently has not released them to the public. The requirements are a large data base, multi-programming capabilities, and the ability to be on-line to any one of the files. All of these are available at extremely competitive price levels.

A number of their installations operate on a cooperative basis. The LaSalle Bank of Chicago has a B3000 unit that is used for savings and mortgage applications at the same time that it is selling its services via remote terminals to thirteen other financial institutions. A total of 200,000 accounts are being handled in this manner.

A product that holds promise for education is the Burroughs Input and

Display System (BIDS). These are terminal units containing a typewriter and visual display, with a separate hard copy print-out attachment also available.

N. Elwood Hansmann
Univac Division of Sperry Rand Corporation

In 1951 the first commercial EDP system, the Univac computer, was delivered to the U.S. Bureau of the Census by the Remington Rand Company. In 1963, after 12 1/2 years of virtually continuous use for twenty-four hours a day, seven days a week, it was judged of sufficient historical interest to be placed on exhibition at the Smithsonian Institute in Washington. In 1955 the Sperry Rand Corporation was formed by the consolidation of the Sperry Corporation and Remington Rand Inc.

Univac builds hardware in three general categories: a 900 series of small to medium scale general purpose machines, a 400 series that is oriented towards the medium and large scale equipment and to data communications work, an 1108 system for a large scale scientifically oriented system.

The 900 series has a limited amount of multi-programming capacity at the higher levels of the series.

The 400 series computers were originally designed to work in a high volume data communications atmosphere with message switching capabilities on a real-time basis. The Bell Telephone Company uses one of the systems for looking up telephone numbers and inventories. They also use it in their intercept system where the calling of a wrong number causes an operator to intrude and ask for the number dialed. She keys in on a CRT terminal and inquires of a computer to determine the status of the number. Ninety of these units are

hooked into one computer to cover the Chicago area.

Some savings and loan associations have their teller windows connected on-line to a remote computer for the purpose of real-updating of customer accounts.

SAS Airlines and Western Union are using the message switching facility of a 418 computer. The former does it on an international basis. Message switching is the routing of communications on a teletype unit to one or more places. The computer directs it to the proper destination(s). If a number of messages are routed for a single point, they all come in at one time.

The 494 unit is used where batch processing exists on a heavier load basis. Airlines use it for reservation-type systems while the classic Westinghouse system described in Chapter V uses it for inventory control and ordering.

The 1108 system has a storage capacity of 262,000 thirty-six bit words. It contains a multi-processor unit with up to three processors and two I/O controllers. At least three programs can be run at one time. A unique feature of Univac systems is that they are compatible with practically all peripheral devices on the market.

The Uniscope 300 is a remote communications terminal combining CRT visual display capabilities with an electric typewriter keyboard and a set of symbols used for keyboard controls. The Uniscope has a sophisticated approach for changing the control characters that are always sent with a message. If one is involved in a payroll application, he puts on the payroll overlay; if CAI, he puts on the corresponding overlay. This also provides a security device that permits only certain personnel to have access to certain files by using the proper overlay.

The Clark Equipment Company 1108 installation is a means by which an almost unlimited cooperative arrangement can be worked out. A central computer has no control of on-site input to it except the tape files. All transaction and systems control information comes in from remote locations. The only function of the local operator is to see that the system is running properly, to monitor the control channel, change tapes, and to check out any error situations that might arise. The remote locations are connected by DCT2000 remote card-reader-printer-punch terminals. Programs are entered and the required information comes back in the appropriate manner. The user always feels that the computer is all his. The number of terminals able to be used at one time is almost unlimited. All of them time-share and each program is given a little slice of computer time. The entire operation is controlled automatically by a software program termed the Executive Control Program. The 1108 system is a very large-scale very powerful system and it is in these big systems that the really exciting things are happening today.

Univac is working on an Experimental Information Management Systems (XIMX). It is an inventory management system written in COBOL to provide for file creation, updating, and file handling facilities in general. The ultimate in management information, a total system, is a language processor that provides one with the capabilities of describing what can be done with a file and the required information or reports desired. This facility is not presently available on any of the computers.

A number of people are talking about a "total information" service and many are working on it, some of the companies being further along than others. It has become such a big bug-a-boo that apparently the only ones that are

really doing a great deal are the software houses. Most of the manufacturers have been "bitten" badly enough that they are "not getting up on the housetops and screaming about what they're going to have."

Hansmann sees important uses for simulation in the planning of school districts' sizes and facilities, both for the present and for the future.

Univac tries not to get closely involved in cooperative arrangements. They make no effort to promote them because this would cause them to wind up as a partner and that is not their business. They attempt to give the customer the tools needed to do their business and let them alone. The company's philosophy is not to tell people how to run their business.

The creation of general application packages has not proven too successful. These always require modification and quite often result in more work than if one started from scratch. If one starts by modifying, he does not learn and the customer does not learn. Not knowing what the problems of creation are, one can modify them right back in.

CHAPTER IX

CONCLUSION AND RECOMMENDATIONS

The purpose of researching and writing this dissertation was to determine the manner in which electronic data processing could best contribute to the field of educational information. In order to discharge this task it was necessary to establish certain parameters within which to explore. One of the problems immediately obvious was that the search would have to range beyond the field of education; it would have to include the status of EDP in business, government, and wherever else the path might lead. Additionally, the uniqueness of the research task required certain modifications in the usual sources of expertise; little information is available in the educational literature.

Preliminary discussion with persons active in the field and reading of the current literature disclosed that an adequate examination of the subject would require the exploration of certain relevant topics as enunciated in Chapter I and repeated here:

1. To what extent has EDP been of assistance in discharging the responsibilities of administration, business, guidance and public relations?
2. What is the proper placement of the EDP administrator in the organizational chart?
3. Is it desirable that the EDP administrator have a professional background as an educator?
4. Should EDP equipment be purchased or rented?
5. Is in-service education for the school staff a worthwhile function?

6. What are the hiring and retention problems of the EDP administrator's staff?
7. Are cooperative arrangements among school districts of value?
8. What are worthwhile devices for communicating with the school and the EDP staff?
9. What is the value of "exception" reporting to school administration?
10. What simulation techniques and approaches appear to have value for educational planners?
11. Does the "total information" concept have value in education?
12. What of the future of EDP in educational information?

From this examination conclusions were drawn and recommendations have been made. The text preceding this chapter represents the examination and research portion of the study. The function of this chapter is to provide the conclusions and recommendations based on the research.

The initial concern for the educator, be he administrator, guidance counselor, or teacher is, most likely, what the new technology can do to ease his burden while at the same time providing an improved learning situation. Chapter III is devoted to the consideration that there is a need for EDP to provide easy access to educational information. It documents aspects of this need as enunciated by writers on the subject as well as by the American Association of School Administrators (AASA). The nature of information systems is also considered, and this is followed by an exposure of the manner in which EDP can contribute to general business accounting, student accounting, general administration, and instructional programs.

In order that one can fully appreciate what some of the educational innovators are doing in the way of unique approaches, Chapter IV examines the specific applications of four concepts: total information services, time-sharing, individual vocational guidance, and commercial information services.

Business and government have been in the forefront of computer creativity since its inception. Chapter V and VI examine a number of the most up-to-date of these applications.

Chapter VIII devotes itself to a comprehensive examination of specific applications in the educational field. This study was predicated on making a determination of the manner in which EDP has been of assistance to administration, business, guidance and public relations. Each institution involved was surveyed concerning the nature of its basic hardware, including the type of data storage facilities and the services that it rendered to its professional staff. No attempt was made to describe all services rendered by all institutions; this would result in unnecessary duplication. A preferred approach and the one used, was to outline the nature of the services performed by each institution and comprehensively treat only those that were indicated to be performing some unique service. Services that do have a common thread were treated at least once.

EDP has been and is becoming of greater assistance in helping administration, business and guidance fulfill their responsibilities. The use of EDP frees the educator from the performance of tasks that are more efficiently done by machine. It allows decisions to be made more meaningful by increased human involvment. It is indicated that continued use and refinement of the

EDP tool will prove of inestimable value in providing the best possible education for all persons.

A number of the first educational EDP installations were predicated on the services that could be rendered in the business realm. Business managers, thereupon, assumed the additional role of EDP manager. This situation was fraught with difficulty. The problems were manifold: the cost of operating computers could not be justified on the basis of their use only in school business and if they were to be extended to other areas, control by the business manager would create confusion. It is now recognized that accurate up-to-date information is a foremost need in any human enterprise and that computers are increasingly able to fulfill this demand. If he is to function efficiently, relatively free from the stresses of intra-institutional rivalry, it is important that the head of the EDP installation report directly to the top management of the institution. In school systems the trend is towards the elevation of the position to that of a deputy superintendency and in business towards a vice presidency. One writer indicates that the computer will eventually eliminate middle-management in business. This will occur as a result of the computer's ability to make their decisions. This gives one an appreciation of the machine's power.

Sharp "party" lines divide EDP administrators who are professional educators from those who are not. The former feel that their value is, initially, as professionals on the school staff and secondarily, as EDP technicians with this marvelous tool at their disposal. The others range from a position diametrically opposite, to one that falls between the two extremes.

In terms of immediate circumstance, this conflict is understandable. However, were one to accept the opinion of Charles Thomas of the University of Illinois, that, "Programming is becoming the least important part of the data processing problem; the biggest concern now is systems' design," it follows that EDP is the tool of a professional educator.

A number of factors are involved in the decision to buy or rent EDP equipment and all seem to point to renting. The chief reason for this is that rental costs come out of current income on a year-to-year basis, whereas purchases of equipment are considered a capital investment and in most instances require specific voter approval. Another problem occurs in replacement; if something can be made to "make do" replacement of it is hard to justify. Witness the schools in large cities, many of which are over 75 years old. Systems that have been renting computers for six or seven years have either replaced them or are about to do so if possible.

In-service education is a neglected area of EDP technology. A number of factors contribute to this. The smaller school system usually has a limited staff, whose time is almost completely occupied in getting the immediate jobs done. What little time may be left is devoted to planning for the future. Another problem in educational EDP lies in the apathy of some teachers and semi-professional personnel. The familiar ways of doing things are comfortable; a deviation from this creates emotional discomfort even though it might lighten the work load. An example of the foregoing occurred in a big-city school system. The teachers were relieved of their irksome monthly attendance summaries in exchange for a new type of multi-holed looseleaf binding. Their

consternation for a number of months was overwhelming, almost as great as occurred a year later when mechanical problems in the EDP system required that the teachers return to the old attendance records.

Manufacturers carry on extensive EDP education for their customers' employees, and in many instances teachers take advantage of this opportunity.

An encouraging sign for the future is the interest displayed by high school students. Wherever computers are used the students form clubs and classes and seemingly cannot keep away from the machines. For example, the Chicago public schools' computer experimentation program for students has attained such popularity that it has been necessary to rent time from a General Electric Data Center in order to keep up with the demand.

Twenty years ago the computer did not exist. Today there are indications that it may soon be the world's third largest business; IBM alone employs over a quarter of a million people. An acceleration of this magnitude has not been without serious problems. Foremost of these, without question, is a continued personnel shortage. Many programs operate to alleviate the difficulty, but it gives no indication of decreasing. The proliferation of new installations -- 40,000 at the present as compared to 10,000 in 1962 and a projected increase to 200,000 in 1975 -- represent an insatiable appetite. Educators interviewed on the subject of personnel see money as the important factor. It is their opinion that schools are not able, because of rigid wage practices, to adjust their salary offerings to meet the competition of business.

Another difficulty is the inability of qualified persons to rise very far in the management area if they are not professional educators. Many become

skilled in school applications but then have to find other positions that allow them increased responsibility. A number leave for installations that have third generation hardware in order to broaden their professional skills.

As is the case in most areas of human endeavor, cooperation in EDP can result in benefit to all concerned parties. Approaches towards these arrangements involve schools whose EDP is running smoothly and will take on the chore of the other schools in their district. This brings additional revenue into the EDP Department and reduces the per school cost of the computer. This principle could well be extended to any number of school districts. If properly handled, this can result in a higher pay scale and benefits to the EDP personnel, insuring better retention and a more sophisticated approach to the resident hardware.

George Stangor of Evanston High School sees a type of cooperation termed time-sharing as the wave of the future. A computer is located in a central position and schools are able to use it through a remote terminal arrangement. A number of these types of applications have been illustrated in this paper: the John R. Miles Corporation of Elk Grove in Chapter V and the LaSalle Bank in Chapter VIII are typical. Probably the ultimate extension of this concept would be a computer utility, similar to an electric or gas utility, wherein the subscriber, be it industry, educational institution or private home, would have available a socket in the wall connected to a centrally-located computer just as the electric socket connects to a centrally-located electric generator. The high-power units coming into use today can handle large numbers of these types of services without the cost being prohibitive to

commercial users. Householders will have to wait until lower prices make it feasible for them.

Cooperation in software use is a reality among certain groups. Control Data Corporation is an example of this. In most cases the manufacturers act as a clearing house by publishing separate brochures illustrating specific applications. The programs for these are available to customers who might need them.

A neglected aspect of EDP is written communication to the school staff. This contrasts sharply with the communication which exists between the manufacturer and its customers; the latter is overwhelming both in its quantity and quality. Where written material does exist, it is usually mimeographed or spirit-duplicated, sketchy in its content and limited in its application. Nowhere was information available that would encourage participation by the staff or give them insights into the manner in which they might avail themselves of the tool and its benefits.

In order to further the idea of exception reporting many administrators must be educated to its value and be willing to cooperate in its implementation. Westinghouse Electric Company has had phenomenal success with it. At any time that certain factors of production show an inordinate deviation, the computer immediately apprises top management. Human intervention then rectifies the problem.

A number of schools do use the exception reporting for such things as payroll and attendance. These could be termed low-level applications that save the staff time, but which are not really concerns of top administration.

Frazier of Chicago City College sees the concept as a "bucking of tradition" wherein many top administrators are unwilling to relinquish authority and insist upon controlling the slightest decisions. This time could be better spent in higher level concerns.

The complex nature of the world requires increasingly complicated decisions in all realms of human activity. Many problems have so many variables that any number of minds devoted to their solution are incapable of considering all of the possibilities. An educator would have a valuable tool were he to possess something that could consider most interrelationships from which to make a selection. The computer is such a device.

Industry is making extensive use of simulation. By using it for forecasting customer needs, Westinghouse was able to close six of their twenty-six warehouses and cut their inventory by 35 per cent while rendering improved service. Research firms such as Caywood-Schiller have built a substantial business out of supplying a simulation research service to any business that has need of it. TRW saved Alberta, Canada six million dollars on an initial investment of eighty-eight million in a medical complex, reduced the buildings from ten to six, and cut operating costs between four and ten million dollars a year.

The Chicago Board of Education will soon embark on a new concept in education termed "magnet" schools. Proper planning for this will not be possible without simulation. The technique has been used in education for the planning of physical facilities, instructional staff, and curriculum. It is even available as a "game" whereby administrators can, vicariously, manipulate

the resources of a system and ascertain what the results will be.

It is in the realm of "total information" that the least amount of agreement exists. By its nature it gives evidence of being all things to all men and, as of the present, appears to have offered little to anyone. Most installations set their sights on it as an eventual goal, as do the manufacturers. No one would say that it is impossible to attain. One would have to conclude that the concept is really an evolving philosophy of infinite depth whose breadth of implementation depends on the intellectual and financial resources available.

Accurate prognostications concerning the future are not difficult to make. The problem that arises is that one must become accustomed to being looked at with a jaundiced eye when making them. This bias will improve as the public continues to be exposed to sophisticated developments and new approaches in the field. Educators will become increasingly concerned with the benefits that they can accrue. As the costs continue to decrease, some startling changes will begin to emerge. In this study it has been indicated that education is a long way behind other users; this is true in certain respects, but need not be foreboding. The uniqueness of the EDP technology, to a great extent, allows new entrants to begin close to the point which the experienced have achieved.

In the not too distant future the cost question will lose the considerable significance that it now has; after all, this is the consideration that has kept the tool out of the educator's hands. When this occurs EDP will be a commonplace source of assistance. With this new-found assistance the educator will be free to develop approaches to problems that heretofore were too

complicated for ordinary procedures. He will be able to concentrate on the parameters and relationships inherent in the problem and not find himself lost in the technology of computerization.

For the short-term outlook the important advances will, most likely, be that of hardware improvement. Computer assisted instruction requires powerful electronics in order to be effective. This, in turn, also means the development of low-cost terminals. The information specialists will be able to avail themselves of this hardware in order to improve the service that they render. The random access principle of audio and visual retrieval will be further extended, and entire libraries will be available with little effort on the part of the user.

The technology and its benefits seem limitless. McLuhan speaks of the time when learning will become, "the principal kind of production and consumption . . . and the entire labor force will be teachers."[1] His prophesy is based on the constantly accelerating nature of EDP research and development.

Recommendations

The AASA asserts that "It (EDP) may do more to modify the shape and destiny of the world than did the invention of the wheel, the printing press, or the industrial revolution."[2] This is no small order and yet present

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[1] Marshall McLuhan, Understanding Media: The Extensions of Man, (New York: McGraw-Hill, 1964), p. 350.

[2] AASA, p. viii.

developments indicate that it is not science fiction fantasy. With this power available education must become cognizant of the manner in which it can best be used. The following are recommendations which are based on the information obtained in this study. This information indicates that these recommendations deal with matters with respect to EDP which should be of great concern to professional educators:

1. Documentation of the services that are available from each EDP department needs considerable improvement. Where it now exists it is rudimentary. In no educational institutions included in this study was any real effort made to acquaint the professional staff with the means by which it might use EDP. An extension of this concept is communication between and among educational EDP installations. This should be implemented in order to share ideas and techniques.

2. Area-wide cooperative arrangements are absolutely essential to achieve the most desirable results. Most individual systems are necessarily limited in terms of hardware and/or personnel. In the event that a key person should leave a small installation, the institution could be thrown into a turmoil. In addition, with more financial resources available, more sophisticated approaches can be undertaken both from the standpoint of hardware and software.

3. Educational administrators must study and become proficient in the use of EDP. All indications point to an increased need which cannot be satisfied if it is not understood. An extension of this requires that computer use become more sophisticated beyond the present preoccupation with tasks that could just as well be done on unit record equipment.

4. In-service education opportunities for the professional staff must be improved and expanded. Present-day practices generally limit computer usage to services that administrators understand and feel are necessary. Proliferation of knowledge of the machine's capabilities will do much to

enhance its work.

5. The concept of real-time, on-line usage by remote terminals must be investigated and implemented. Hardware with multi-programming capabilities is becoming increasingly more available and is the wave of the future. In addition, this approach constitutes the entrance into "computer utility" applications.

6. Random access audio and video retrieval systems as described in Chapter VII have great potential for curriculum enrichment and should be studied to determine how they can be implemented.

7. Overall direction of the information system must be placed in the hands of a high-level administrator who reports directly to the Superintendent of the institution. This is the only approach that will assure its proper functioning.

8. Simulation must be given a great deal of thought and discussion at all levels of administration. Here is where the difficulties in education can be evaluated and solved expeditiously.

9. Educators must keep a continuing open mind concerning the possibilities of EDP. All indications point to the present as being the infancy period. The future is limited only by human intelligence and creativity.

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USE THE DOTTED LINE TO ALIGN TYPEWRITER HORIZONTALLY

CHICAGO PUBLIC SCHOOLS
REGISTRATION FORM

NAME OF SCHOOL: LEMOYNE | UNIT: 4440

STUDENT NO.	STUDENT NAME (LAST FIRST MIDDLE)	BIRTHDATE	BIRTHPLACE (CITY STATE)	OMIT
00175358	FERGUSON MICHAEL	052552	CHICAGO ILL	

SEX	BIRTH CERTIFICATE	GUARDIAN NAME (LAST FIRST MI)	RELA.	MOTHER'S MAIDEN NAME (LAST FIRST)
1	11356784	SMITH LORRAINE T	2	BUTE LORRAINE

CHICAGO ADDRESS	ZONE	PHONE	E.T.	E.S.	ENTRY DATE	ROOM	GRADE	SPEC.
838 W WAVELAND	13	LA81960	1	3	090964	203	05	

LAST C. SCHL.	NON CHGO SCHOOL TRANSFERRED FROM
5550	ST ANDREWS CHICAGO ILL

STUDENT NO.	STUDENT NAME (LAST FIRST MIDDLE)	BIRTHDATE	BIRTHPLACE (CITY STATE)	OMIT
00175382	GRAVES WILLIAM HENRY	051753	CHICAGO ILL	

SEX	BIRTH CERTIFICATE	GUARDIAN NAME (LAST FIRST MI)	RELA.	MOTHER'S MAIDEN NAME (LAST FIRST)
1	11253635302	GRAVES ROBERT B	1	ALMGREN ULLA

CHICAGO ADDRESS	ZONE	PHONE	E.T.	E.S.	ENTRY DATE	ROOM	GRADE	SPEC.
3712 N PINE GROVE	13	LA58132	1	2	090964	203	05	

LAST C. SCHL.	NON CHGO SCHOOL TRANSFERRED FROM
5550	

STUDENT NO.	STUDENT NAME (LAST FIRST MIDDLE)	BIRTHDATE	BIRTHPLACE (CITY STATE)	OMIT
00175447	HAWKINS DONALD RAY	020552	SEBREE KY	

SEX	BIRTH CERTIFICATE	GUARDIAN NAME (LAST FIRST MI)	RELA.	MOTHER'S MAIDEN NAME (LAST FIRST)
1		SELLERS TEMPLE D	2	LYLE TEMPLE

CHICAGO ADDRESS	ZONE	PHONE	E.T.	E.S.	ENTRY DATE	ROOM	GRADE	SPEC.
3705 N BROADWAY	13	LI98942	2	6	091564	203	05	

LAST C. SCHL.	NON CHGO SCHOOL TRANSFERRED FROM
	RICH VALLEY ELEM RICH VALLEY VA

STUDENT NO.	STUDENT NAME (LAST FIRST MIDDLE)	BIRTHDATE	BIRTHPLACE (CITY STA	OMIT
00175412	HORSTEIN DAVID	0504533		X

SEX	BIRTH CERTIFICATE	GUARDIAN NAME (LAST FIRST MI)	RELA.	MOTHER'S MAIDEN NAME (LAST FIRST)

CHICAGO ADDRESS	ZONE	PHONE	E.T.	E.S.	ENTRY DATE	ROOM	GRADE	SPEC.

LAST C. SCHL.	NON CHGO SCHOOL TRANSFERRED FROM

STUDENT NO.	STUDENT NAME (LAST, FIRST MIDDLE)	BIRTHDATE	BIRTHPLACE (CITY STATE)	OMIT
00175412	HORSTEIN DAVID	050453	CHICAGO ILL	

SEX	BIRTH CERTIFICATE	GUARDIAN NAME (LAST FIRST MI)	RELA.	MOTHER'S MAIDEN NAME (LAST FIRST)
1	11253632960	HORSTEIN ALEX	1	SOFO GLORIA

CHICAGO ADDRESS	ZONE	PHONE	E.T.	E.S.	ENTRY DATE	ROOM	GRADE	SPEC.
923 W ADDISON	13	FR23173	1	1	090964	203	41	

LAST C. SCHL.	NON CHGO SCHOOL TRANSFERRED FROM

STUDENT NO.	STUDENT NAME (LAST FIRST MIDDLE)	BIRTHDATE	BIRTHPLACE (CITY STATE)	OMIT
00175471	MARK THOMSON ROBERT	080951	CHICAGO ILL	

SEX	BIRTH CERTIFICATE	GUARDIAN NAME (LAST FIRST MI)	RELA.	MOTHER'S MAIDEN NAME (LAST FIRST)
1	HR 57599	MARK LOIS M	2	ROSCH LOIS

CHICAGO ADDRESS	ZONE	PHONE	E.T.	E.S.	ENTRY DATE	ROOM	GRADE	SPEC.
3622 N FREMONT	13	4726394	1	2	090964	203	05	23

LAST C. SCHL.	NON CHGO SCHOOL TRANSFERRED FROM
2270	

STUDENT NO.	STUDENT NAME (LAST FIRST MIDDLE)	BIRTHDATE	BIRTHPLACE (CITY STATE)	OMIT
00175528	NEEDHAM WILLIAM ROGER	112451	CORPUS CHRISTI TEX	

SEX	BIRTH CERTIFICATE	GUARDIAN NAME (LAST FIRST MI)	RELA.	MOTHER'S MAIDEN NAME (LAST FIRST)
1	TEX 3886	NEEDHAM MARVIN K	1	CRISANTES C

CHICAGO ADDRESS	ZONE	PHONE	E.T.	E.S.	ENTRY DATE	ROOM	GRADE	SPEC.
842 W WAVELAND	13		1	2	091864	203	05	

LAST C. SCHL.	NON CHGO SCHOOL TRANSFERRED FROM

(Figure 1)

TRANSFER-IN-NCPS INTRA-YR

02166372 | RN. 362 | GR. 02 | SE. 00

MUENCH JOSEPH CLYDE
702 W CUYLER AV
PH. 2843972 A. Z.13 SEX- M
B. DATE 09/18/58 BV-023113666
B. PLACE CHICAGO ILL
MUENCH LEWIS J FATHER
OSBOURN SHIRLEY M. MDN. NAME

ENT LEMOYNE 4440
02/28/67 (23) 362 02 00 FROM
ST MARKS CHICAGO ILL

LV YOUR SCHOOL 4440
03/06/68 (31) 362 02 00 TO
OTHER SCHOOL (9999)

DID NOT LEAVE

STATUS CARD

CHICAGO PUBLIC SCHOOLS
EL. HI. 108-DP (REV. 7-67)

STUDENT NO.	UNIT	NAME OF SCHOOL
02166372	4440	LEMOYNE 54

NON-CHICAGO SCHOOL TRANSFERRED TO

CHICAGO ADDRESS
NUMBER DIR. STREET NAME APT. OR LOT

ZONE PHONE

78

ROOM/DIV.	GRADE	SPEC. ED.	CHANGE CODE	DATE EFFECTIVE MO. DAY	CHICAGO PUBLIC SCHOOL TRANS. TO
7	7	7	7	7 7 7 7	7 7 7 7

(Figure 2)

FORM HI 11DP

HIGH SCHOOL SUBJECT ELECTIONS

CHICAGO PUBLIC SCHOOLS

WORK FORM
This is NOT a machine mark reader form.
DO NOT send to Data Processing Dept.
Read instructions on back before using.

NAME	PRESENT DIV.	GRADE	SEX	SP ED	UNIT NO	STUDENT NO

	PER	SUBJECT	LEV	YR	ROOM
NOW	1				
	2				
	3				
	4				
	5				
TA	6				

MAJORS

THIS IS A MACHINE MARK READER FORM
DO NOT BEND OR MAKE UNNECESSARY MARKS.
READ INSTRUCTIONS ON REVERSE SIDE
CAREFULLY. BEFORE USING.

FORM HI 11DP

HIGH SCHOOL SUBJECT ELECTIONS
CHICAGO PUBLIC SCHOOLS

NAME | PRESENT DIV | GRADE | SEX | SP ED | UNIT NO | STUDENT NO

UNIT NO. STUDENT NO.

Z E R O

Lev.

(Figure 3)

NOTE STU.NO.	CODE	DIV.	NAME	SUBJECTS 1	2	3	4	5	6
09397804	T	107	WESTRUM CHRISTINE	13110	43420	33110	53810	94600	011
08048711	T	107	YANDELL PHILLIP CARL	13110	45420	35210	53310	93805	012
LV3308041075	N	110	MCNALLY MICHAEL	13110	42110	33110	60410	60310	012
08041911	S	108	**********	12110	42110	23210	32110	93110	012
03002451	R	905	**********	13110	23610	53320	33310	01235	601
03050866		919	ODIERNO PATRICK	13130	23610	53820	33410	01230	720
00875791	CE	919	OMALLEY MICHAEL	13130	23610	74210	60410	01230	01
09541942	E	919	PARKANSKY DAVID	13140	60410*	74210	01240	60410*	72
03051838	E	915	VANDERSCHOT MARK	13130	23610	53810	60410	*****$	60
4.0 14939050	T E	000	KAY RICHARD	13110	43310	35210	**810$	94800	01
03023354	E	905	BROWN ROSE MARIE	12110	23610	42110	72010	00120$	84

THE FOLLOWING APPEARS ON THE LAST PAGE OF LISTING

TOTAL SUBJECT ELECTIONS ON THIS REPORT FOR UNIT 1230 2,099

(Figure 4)

UNIT 1950 TALLY

00006	00007	00600	00800	01100	01110	01120	01122	01125	01126	01130	01200
1080	1	2176	389	1	260	272	1	1	1	269	1
01220	01221	01225	01230	01420	01430	01910	02900	02910	02920	02930	03301
423	3	136	453	2	2	1	1	123	32	80	1
03610	07210	08600	08800	10120	10220	11010	11110	11120	11130	11920	12110
1	1	3	7	1	2	16	3	14	1	1	203
15110	15120	15130	23210	23310	23410	23411	23412	23610	23810	23812	23911
33	48	80	4	1	271	267	259	842	16	1	262

(Figure 5)

UNIT 1950 POTENTIAL CONFLICT CLASS SIZE 40

	02920	03301	03610	07210	08600	08800	10120	10220	11010	11110	11120	
03301		1										0330
03610			1									0361
07210				1								072L
08600					3							0860
08800						7						0880
10120						1	1					1012
10220								2				1022
11010	1								16			1101
11110										3		1111
11120											14	1112

(Figure 6)

UNIT 1950 SUBJECT 08800 SUBJECT ELECTION COURSE ROSTER

NAME	GR	DIV	SEX	STU.NO	NAME	GR	DIV	SEX	STU.NO.
FIZER WILLIAM	10	806	M	03000311	SKOTNIK JAMES	10	820	M	00789365
LUKOWSKI DAVID	10	820	M	00781096	VEGA EDWIN	10	820	M	00781258
PRUITT RAYMOND	10	820	M	09727140	WEBB RONNIE	10	820	M	00786411
RAMIREZ MANUEL	10	820	M	00782246					

(Figure 7)

CHICAGO PUBLIC SCHOOLS

MASTER SCHEDULE LISTING

SCHOOL: MAIN HIGH SCHOOL

SHEET IDENTIFICATION: EXAMPLES

SPEC "X":

UNIT NO.: 1650

PAGE NO	LINE NO	TEACHING POS NO	TERM	SUBJECT NO.	SECT. NO.	CLASS SIZE	5X OR LESS			6 - 10X			11 - 15X			16 - 20X			TCHR. INIT.
							ROOM	PER	DAYS	ROOM	PER	DAYS	ROOM	PER	DAYS	ROOM	PER	DAYS	
02	01	01234		00000	01	175	1300	1	55			STUDY HALLS							ABC
02	02	02345		00000	02	100	3190	1	55			AUTOMATIC							BCD
02	03	04567		00000	01	175	1300	2	55										DEF
02	07	08991		00000	01	125	1000	3	55			ASSIGNED STUDY HALL							SRP
03	10	00000		99900	01	650	0100	4	55			AUTOMATIC LUNCH							
03	11	00000		99900	02	550	0100	4	55			(NOT REQUESTED BY STUDENTS)							
03	12	00000		99900	01	490	0100	5	55										
04	14	00000		99901		490	0100	4	55			ASSIGNED LUNCH- FRESHMEN							
04	15	00000		99902		490	0100	5	55			ASSIGNED LUNCH- SOPHOMORES							
05	18	01234		99701		100	3120	4	55			DIVISION-LUNCH							ABC
05	19	02345		99702		100	3120	4	55			(ALSO 998XX LUNCH-DIVISION)							BCD
06	07	00000		00191		999	0001	0	55			LATE STARTS OR EARLY DISMISSALS							
06	08	00000		00192		999	0000	1	55			(9 PER.STU.IN A 10 PER.SCHL.)							
07	01	01234		13110		030	1160	3	55			SINGLE PERIOD SUBJECTS							ABC
07	02	02345		13110	01	030	2250	4	55			(MORE THAN ONE CLASS PER							BCD
07	03	04567		13110	02	030	2120	4	55			PERIOD REQUIRED)							DEF
08	05	06789		53330	01	015	3290	7	55			(TWO TERMS IN ONE CLASS)							MEJ
08	06	06789		53340	01	015	3290	7	55										MEJ
08	09	05432	F	13710		030	2130	4	55			SEMESTER OFFERED IN FALL							JET
08	10	06754	S	13810		030	2130	4	55			SEMESTER OFFERED IN SPRING							JET
09	01	03675		33210		030	1020	5	55	1020	6	25	MULTIPLE PERIOD						GHI
09	02	06375		33310		030	2180	4	34	2120	4	25	2120	5	25				FGH
09	03	05763		60410		028	0130	6	55	0130	7	55							MEG
09	04	03977		64610		020	0400	2	55	0400	3	55	0400	4	55				HRS

(Figure 8)

MASTER SCHEDULE PREPARATION CHART

	FIELD NAME	1 STUDY HALLS	2 LUNCHROOMS	3 SINGLE PERIOD	4 MULTIPLE PERIOD	5 LATE STARTS	6 ACTIVITIES
A	PAGE NUMBER	YES	YES	YES	YES	YES	YES
B	LINE NUMBER	YES	YES	YES	YES	YES	YES
C	TEACHER POS. NUMBER	"00000"	"00000"	POS.NO. OF CLASS TCHR OR CLASS	POS.NO. OF CLASS TCHR OR CLASS	"00000"	POS.NO.OF CL TCHR OR CLAS
D	ALPHABETIC TERM	NONE	NONE	YES IF FALL OR SPRING	YES IF FALL OR SPRING	NONE	NONE
E	SUBJECT	"00000"AUTO "88801"REQD "888XX"REQD	997XXDIVLUNCH 998XXLUNCHDIV 99900 AUTO	YES	YES	YES	YES
F	SECTION NO.	YES	IF NEEDED	IF NEEDED	IF NEEDED	IF NEEDED	IF NEEDED
G	MAX.CLASS SIZE 5X OR LESS	YES MAY BE "000"	YES	YES	YES	"999"	YES
H	ROOM NO.	YES	DIV ROOM NO. IF 997XX OR 998XX	YES	YES	"000"	YES
I	PERIOD	YES	YES	YES	YES	YES 1ST	YES
J	DAYS CODE 6X- 10X	YES	YES	YES	YES	YES	YES
K	ROOM	NONE	NONE	NONE	YES	IF REQD	IF REQD
L	PERIOD	NONE	NONE	NONE	YES	IF REQD 2ND	IF REQD
M	DAYS	NONE	NONE	NONE	YES	IF REQD	IF REQD
	11X -15X						
N	ROOM-	NONE	NONE	NONE	IF REQD	IF REQD	IF REQD
O	PERIOD	NONE	NONE	NONE	IF REQD	IF REQD-3RD	IF REQD
P	DAYS	NONE	NONE	NONE	IF REQD	IF REQD	IF REQD
	16X - 20X						
Q	ROOM-	NONE	NONE	NONE	IF REQD	IF REQD	IF REQD
R	PERIOD	NONE	NONE	NONE	IF REQD	IF REQD-4TH	IF REQD
S	DAYS	NONE	NONE	NONE	IF REQD	IF REQD	IF REQD
T	TEACHERS INITIALS	IF REQD	IF REQD	YES	YES	NONE	YES

(Figure 9)

LEGAL NAME _____ ADVISER _____ SCHOOL YEAR _____ CLASS OF _____
LAST FIRST INITIAL

ADDRESS _____ VILLAGE _____ PHONE _____ DATE ___/___/___
MO. DAY YEAR

SCHOOL _____ DATE OF BIRTH ___/___/___ SEX (M OR F) _____ I. D. NO. _____ REG. APPROVED BY _____
EAST OR WEST MO. DAY YEAR

TO BE FILLED OUT BY THE PARENT

Date _____

My signature below affirms that —

1. I approve of the selection of subjects listed on this card.
2. I am a resident of the New Trier Township High School District (Check one) Yes ☐ No ☐
3. My relationship to the student named on this card is (check one, or explain below)

Father ☐ Mother ☐ Legal Guardian ☐

If other than above, explain in full _____

Signature _____

Please print below the correct home mailing address for use of the school office. Use Mr. and Mrs. except when it does not apply. (Cross out two.)

Mr.
Mrs.
Mr. and Mrs. _____

_____
Street Village

NEW TRIER TOWNSHIP HIGH SCHOOLS
WINNETKA & NORTHFIELD, ILLINOIS

CODE	SUBJECT

☐OVER FOR REMARKS

(Figure 10)

STUDENT NO.	STUDENT NAME	ADV. NO.	DEPT NO.	SUBJECT AND CLASSIFICATION	YR	SEM	TEACHER	TEACHER NO.	P.D.

MARK BELOW IF THIS STUDENT IS REGISTERED FOR COURSE AS ONE OF THE FOLLOWING:

REPEATING

REVIEWING (0 CREDIT)

USE SPECIAL MARKING PENCIL ONLY

N.T.H.S.

1ST GRADE PERIOD

GRADE				
A	1	1	1	
B	2	2	2	
C	3	3	3	
D	4	4	4	
	5	5	5	
F	6	6	6	
P	7	7	7	
Y	ONE MARK PER COLUMN ONLY			
I				

PASSING WITH CREDIT

NOT PRESENTLY IN THIS CLASS. NO GRADE OR CREDIT

INCOMPLETE

TEACHERS' REASON FOR LOW GRADES

1. INADEQUATE PREPARATION
2. REQUIRED WORK LATE, INCOMPLETE, OR NOT DONE
3. FAILURE TO SEEK EXTRA HELP
4. WRITTEN WORK POOR IN CONTENT OR FORM
5. TESTS UNSATISFACTORY
6. INATTENTION IN CLASS
7. WORK MISSED ON ACCOUNT OF ABSENCE

NOTE: NO MORE THAN THREE OF THE ABOVE SEVEN REASONS MAY BE USED IN ANY ONE GRADE PERIOD.

SEM. FINAL GRADE

A	A	
B	B	
C	C	
D	D	
F	F	
P	P	
Y	Y	
I	I	

CREDITS EARNED: 10 0 1 2 3 4 5 6 7 8 9

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

J34785 J34786

(Figure 11)

SERIAL NO. | STUDENT | ADVISER | SCHOOL YEAR | SEMESTER

NEW TRIER TOWNSHIP HIGH SCHOOLS

NORTHFIELD & WINNETKA ILLINOIS

A-EXCELLENT
B-GOOD
C-AVERAGE
D-BELOW AVERAGE
F-FAILING
P-PASSING WITH CREDIT
I-INCOMPLETE
Y-NO GRADE OR CREDIT

TEACHER'S REASONS FOR LOW GRADE

1 Inadequate preparation
2 Required work late, incomplete or not done
3 Failure to seek extra help
4 Written work poor in content and/or form
5 Tests unsatisfactory
6 Inattention in class
7 Work missed on account of absence

COURSE	TEACHER	REPEAT	REVIEW	MAJOR		MID-SEMESTER GRADE	SEMESTER GRADE	CREDITS EARNED	MID-SEMESTER ONLY	COURSE CODE

DAYS ABSENT	TIMES TARDY	DAYS ABSENT	TIMES TARDY		
				SEMESTER TOTAL	
				PREVIOUS TOTAL	
				TOTAL TO DATE	

FIRST GRADE PERIOD | SECOND GRADE PERIOD

GRADE REPORT

FORM 7

(Figure 12)

PERIOD 1 SH EA 353 SEATING PLAT

SEAT	USED	NAME	NO.	YR	ADVISER
1	MTWRF	ABELSON DENNIS	00149	9M	MARZ
2	MTWRF	ABMAN KAREN RUTH	00179	9F	KEES
3	MTWRF	AGRON SHEILA H	00634	9F	BLODGETT
4	MTWRF	AHLSTRAND VERNON R	00674	9M	MONAGHAN
5	T RF	ALCORN DAVID E	00892	9M	LILL
5	M W	BROWNLEE DONALD E	10702	9M	ZIBART
6	T RF	ALEXANDER BRIAN E	01030	9M	ZIBART
6	M W	CHOLL WENDY M	13655	0F	SHOEMAKER

(Figure 13)

03-06-68 TO 04-05-68

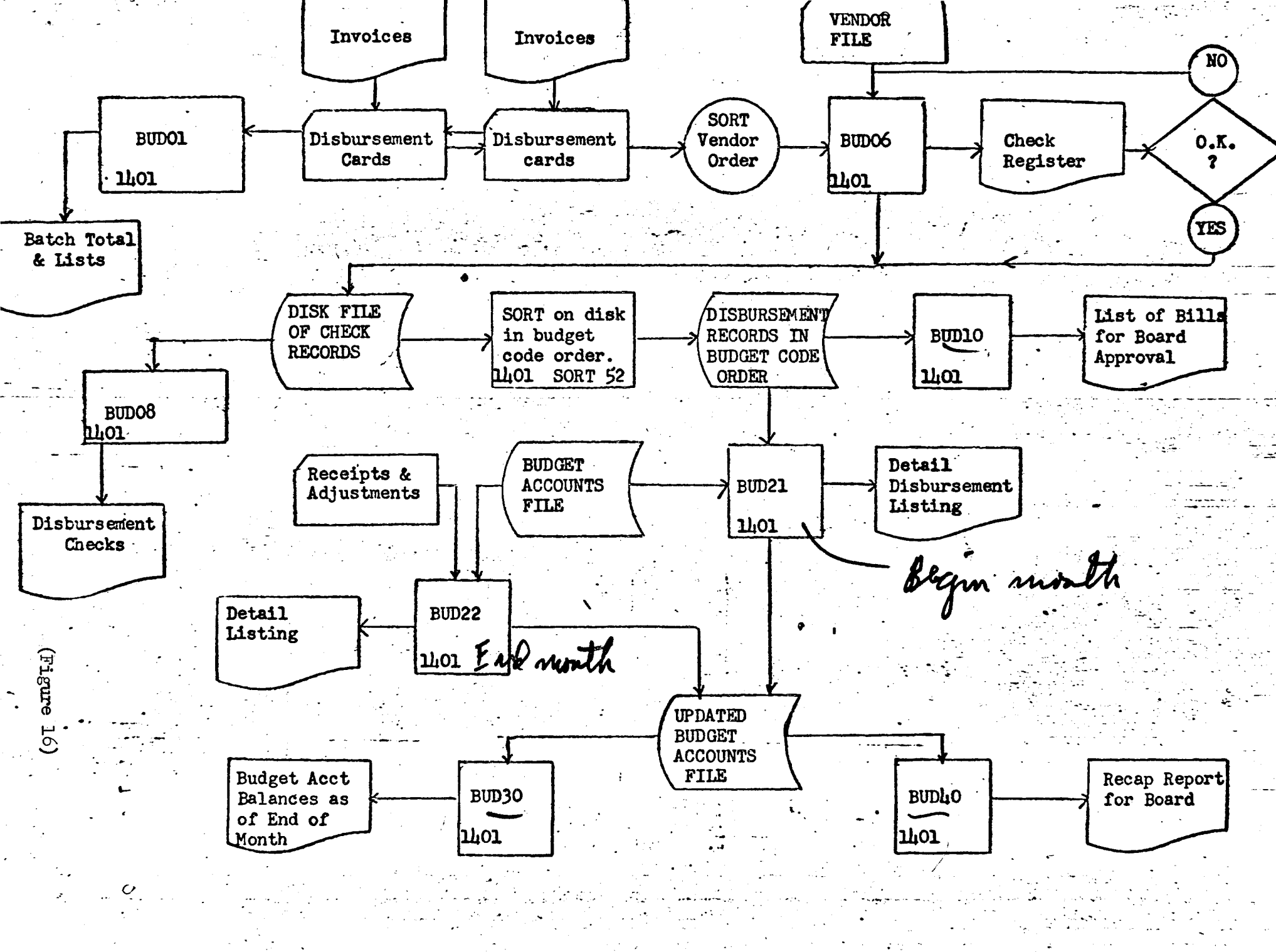
PAGE 2 WEST SENIOR BOYS

NUMBER	STUDENT NAME	DATE	DAYS ABSENT	TARDY TIMES	SIGN-OUT TIMES	SIGN-IN TIMES
		M 03-11-68	HALF			11 20
		T 03-19-68			2 56	
		M 03-25-68	FULL			
		TOTAL	1.5	1		
06200	BERMAN BRUCE	W 03-06-68		9 16		
		M 03-18-68			1 30	
		T 03-19-68	FULL			
		F 03-22-68	FULL			
		M 03-25-68	FULL			
		T 03-26-68	FULL			
		F 03-29-68	HALF			11 00
		TOTAL	4.5	1		
06594	BESS ARTHUR G	R 03-28-68	FULL			
		F 03-29-68	FULL			
		TOTAL	2.0			
06601	BESSEN JAMES E	W 03-06-68	FULL			
		M 03-11-68	FULL			
		T 03-12-68	FULL			
		W 03-13-68	FULL			
		R 03-14-68	FULL			
		M 03-18-68			11 25	12 30
		TOTAL	5.0			

(Figure 14)

ITEM		A	B	C	D	E	OMIT & MM	DISCRIM-INATION	DISTRAC-TORS	DIFFI-CULTY
1	%TO	2	0	3	90*	0	5			
1	%UP	0	0	3	97*	0	0			
1	%LO	3	0	3	84*	0	10			
1	PHI	- 5	0	0	22*	0	-17	O.K.		V. EASY
2	%TO	52*	17	24	2	0	5			
2	%UP	66*	9	25	0	0	0			
2	%LO	39*	26	23	3	0	10			
2	PHI	28*	-17	2	- 3	0	-10	O.K.	C	OPTIMUM
3	%TO	2	0	89*	5	0	5			
3	%UP	0	0	100*	0	0	0			
3	%LO	3	0	77*	10	0	10			
3	PHI	- 5	0	37*	-16	0	-16	O.K.		V. EASY
4	%TO	33	60*	0	0	0	6			
4	%UP	38	63*	0	0	0	0			
4	%LO	29	58*	0	0	0	13			
4	PHI	9	5*	0	0	0	-14	POOR	A	OPTIMUM

(Figure 15)


Invoices
Invoices
VENDOR FILE
NO
BUD01 1401
Disbursement Cards
Disbursement cards
SORT Vendor Order
BUD06 1401
Check Register
O.K. ?
YES
Batch Total & Lists
DISK FILE OF CHECK RECORDS
SORT on disk in budget code order. 1401 SORT 52
DISBURSEMENT RECORDS IN BUDGET CODE ORDER
BUD10 1401
List of Bills for Board Approval
BUD08 1401
Disbursement Checks
Receipts & Adjustments
BUDGET ACCOUNTS FILE
BUD21 1401
Detail Disbursement Listing
Begin month
Detail Listing
BUD22 1401 End month
UPDATED BUDGET ACCOUNTS FILE
Budget Acct Balances as of End of Month
BUD30 1401
BUD40 1401
Recap Report for Board

(Figure 16)

NEW TRIER HIGH SCHOOLS - DISTRIBUTION OF BUDGET DISBURSEMENTS ONLY MARCH 11, 1968 PAGE 010

DESCRIPTION	P.O.	CHECK	CTRL/ADMIN	EAST	WEST		
MACHINE RENTAL		04036	21.00				PITNEY-
914 COPIER		04115	397.02				XEROX C
REIMBURSE POSTAGE		04120	5.89				DONALD
REIMBURSE CALENDAR		04132	73.22				NEW TRI
			10,774.08 *	1,474.79 *	244.44 *	CURR YTD	
ART			4,200.00	.00	.00	ADJ BUDG	
			6,432.23	5,036.79	1,395.44	PREV YTD	
ART SUPPLIES	6614	03857	165.34		165.34		AMERICAN
ART SUPPLIES	4701	03880	5.00		5.00		BESS HAR
ART SUPPLIES	4701	03880	1.34		1.34		BESS HAR
ART SUPPLIES	4701	03880	3.46		3.46		BESS HAR
MOULDING PLASTER	6659	03892	21.00		21.00		BUILDERS
MOULDING PLASTER	4701	03892	5.70		5.70		BUILDERS
MOULDING PLASTER	4701	03892	2.85		2.85		BUILDERS
MOULDING PLASTER	4701	03892	2.85		2.85		BUILDERS
ART SUPPLIES	4701	03904	13.50		13.50		CLAY HOU
ART SUPPLIES		03947	85.00	85.00			GRAPHIC
ART SUPPLIES	6793	03947	45.21	45.21			GRAPHIC
ART SUPPLIES	6615	03947	132.68		132.68		GRAPHIC
ART SUPPLIES	6553	03949	53.00		53.00		GRAYS DI
ART SUPPLIES	6553	03949	27.40		27.40		GRAYS DI
ART SUPPLIES	6553	03949	141.43		141.43		GRAYS DI
SUPPLIES FROM BOOKSTORE		04011	1.65		1.65		NEW TRI
SUPPLIES	4719	04031	12.16	12.16			PAVLIK E
SUPPLIES	6613	04032	34.15		34.15		PAVLIK E
STONEWARE CLAY	5458	04043	100.00	100.00			NICHOLAS
MOIST CLAY	5458	04043	50.00	50.00			NICHOLAS
SAW BLADES	6612	04067	16.22		16.22		SEARS RO
SUPPLIES	4718	04086	5.52	5.52			E B TAYL
			7,357.69 *	5,334.68 *	2,023.01 *	CURR YTD	

(Figure 17)

NEW TRIER TOWNSHIP HIGH SCHOOLS - BUDGET ACCOUNTS AUARY 29 1968 PAGE 004

ACCOUNT	DESCRIPTION		ORIG BUDGET	ENTS	CURR MONTH	YEAR TO DATE	BALANCE
		WEST	•	•	158.01	878.59	878.59
B507.924	ROOFS	CTRL	10,000.00	•	30.50	6,261.71	3,738.29
		EAST	•	•	30.50	6,261.71	6,261.71
		WEST	•	•	.00	•	.00
B507.925	HEATING	CTRL	13,500.00	•	1,186.06	11,199.49	2,300.51
		EAST	•	•	448.30	8,170.83	8,170.83
		WEST	•	•	737.76	3,028.66	3,028.66
B507.926	ELECTRICAL	CTRL	4,000.00	•	655.10	4,611.02	611.02
		EAST	•	•	601.69	3,557.40	3,557.40
		WEST	•	•	53.41	1,053.62	1,053.62
B507.927	PLUMBING	CTRL	5,500.00	•	1,090.15	3,651.62	1,848.38
		EAST	•	•	977.86	3,484.61	3,484.61
		WEST	•	•	112.29	167.01	167.01
B507.928	OTHER - INC. RUG CLEAN	CTRL	6,000.00	•	396.48	5,680.10	319.90
		EAST	•	•	319.64	4,698.37	4,698.37
		WEST	•	•	76.84	981.73	981.73
B507.92	BUILDINGS	CTRL	50,900.00	.00	3,516.30	38,151.59	12,748.41
		EAST	.00	.00	2,377.99	31,968.28	31,968.28
		WEST	.00	.00	1,138.31	6,183.31	6,183.31
B507.9	OTHER	CTRL	54,800.00	.00	3,516.30	42,065.48	12,734.52
		EAST	.00	.00	2,377.99	34,744.27	34,744.27
		WEST	.00	.00	1,138.31	7,321.21	7,321.21
B507.0	MAINTENANCE	CTRL	54,800.00	.00	3,516.30	42,065.48	12,734.52
		EAST	.00	.00	2,377.99	34,744.27	34,744.27
		WEST	.00	.00	1,138.31	7,321.21	7,321.21

(Figure 18)

BUDGET ACCOUNT	DESCRIPTION	BUDGETED AMOUNT	CURRENT MONTH EXPENDED	YEAR-TO-DATE EXPENDED	YTD/BUDGET LAST YR	YTD/BUDGET THIS YR	BALANC
E101.0	IMPREST & PETTY CASH	.00	.00	995.00-		0%	995.0
E1	ED. FUND ASSETS	.00	.00	995.00-		0%	995.0
	BALANCE LAST JULY 1ST	23,500.00		23,500.00			
	TOTAL CASH	23,500.00	.00	22,505.00		96%	995.0
E401.0	TAXES	5,668,027.00	98,263.92	2,535,808.83	38%	45%	3,132,218.
E402.11	GENERAL STATE AID	251,800.00	25,380.25	186,204.66	64%	74%	65,595.
E402.4	DRIVER TRAINING	50,000.00	.00	.00	-	%	50,000.
E402.5	SPECIAL EDUCATION	70,000.00	.00	75,941.50	132%	108%	5,941.
E402.9	OTHER GOVT. AID	.00	.00	13,370.40	-	0%	13,370.
E404.0	INVESTMENT INTEREST	90,000.00	10,653.12	59,551.03	93%	66%	30,448.
E405.0	SALE OF PROP & EQUIP	.00	.00	807.44	-	0%	807.
E406.9	OTHER TUITION	3,000.00	661.81	6,618.10	33%	221%	3,618.
E409.0	OTHER CASH REVENUE	13,000.00	766.45	19,073.08	-	147%	6,073
E411.0	ADULT EDUCATION	33,000.00	3,813.90	37,508.60	100%	114%	4,508
E412.0	SUMMER SCHOOL	110,000.00	.00	6,586.43	2%	6%	103,413.
E413.0	ATHLETIC PROGRAM	28,000.00	6,552.76	17,805.41	61%	64%	10,194.
E414.0	BOOKSTORE	186,500.00	13,540.09	145,422.00	76%	77%	43,078.
E415.0	LUNCH PROGRAM	355,000.00	34,972.30	218,158.77	59%	61%	136,84
E419.0	OTHER STUDNT & COMM. SER	31,000.00	2,481.39	20,491.28	45%	66%	10,508.
E4	ED. FUND REVENUES	6,891,327.00	197,085.99	3,343,347.73	43%	49%	3,547,979.
	BALANCE LAST JULY 1ST	1,569,889.20		1,569,889.20			
	TOTAL CASH	8,461,216.20	197,085.99	4,913,236.93	60%	58%	3,547,979.
E501.0	ADMINISTRATION	374,620.00	39,025.56	250,467.54	63%	67%	124,152.
E502.0	INSTRUCTION	5,023,509.00	471,305.99	3,189,071.72	63%	63%	1,834,437.
E503.0	ATTENDANCE	11,100.00	925.00	7,286.76	66%	66%	3,813.
E504.0	HEALTH	40,500.00	3,689.36	24,391.88	57%	60%	16,108.
E506.0	OPERATION OF PLANT	148,850.00	22,525.58	101,640.52	68%	68%	47,209.
E507.0	MAINTENANCE	18,500.00	1,517.27	12,634.59	58%	68%	5,865.
E508.0	FIXED CHARGES	46,000.00	23.55	9,717.25	58%	21%	36,282.
E511.0	EVENING SCHOOL	30,500.00	604.85	16,974.46	58%	56%	13,525.
E512.0	SUMMER SCHOOL	169,000.00	.00	119,340.79	80%	71%	49,659.
E513.0	ATHLETIC PROGRAMS	41,000.00	6,419.82	38,754.91	82%	95%	2,245.

(Figure 19)

WRIGHT MARION	F	69	04
WUNSCH KEN S	M	69	00
WUNSCH KATHY	F	71	03
WYATT JAMES	M	70	01
XIRAU KEN MIKE	M	69	00
YAKOVLEV CRAIG	M	71	12
YAMADA PATRICIA J	F	68	02
YAMALIS DONNA	M	70	00
YEARWOOD PAT	F	69	00
YOUNG MARION	M	71	03
YOUNG PATRICIA	F	68	07
ZABAR ROBERT	M	71	00
ZACCO LOUIS	M	68	00
ZEITLIN JOYCE	F	69	01
ZICHERMAN SHARON	F	71	01
ZIDELL RANDALL	M	68	00
ZILUCK SUSAN J	F	71	05
ZIMMER SHELLEY	F	71	09
ZIMMERN SHARI	F	70	11
ZOREK MICHAEL	M	71	00
ZUAR KENNETH	M	68	01
ZUCKER ROBERT	M	71	03
ZWICK CYNTHIA	F	69	00

NAME OF SCHOOL: ARLINGTON
ATTENDANCE REGISTER
WEEK ENDING 05/20/66

	1971	1970	1969	1968	OTHER	TOTAL
BOYS	317	342	318	244		1221
GIRLS	347	334	316	267		1264
UNCLIF.	1	2	2	1		6
TOTAL	665	678	636	512		2,491

(Figure 20)

TOWNSHIP HIGH SCHOOL DISTRICT 214
MOUNT PROSPECT, ILLINOIS

ELK GROVE HIGH SCHOOL — FROM 01/06/6- TO 02/03/6-

		BOYS	GIRLS	TOTAL
I	ENROLLMENT - SEPTEMBER, 196-	708	727	1,435
II	DROPPED DURING THE MONTH	3	2	5
	DROPPED PREVIOUSLY	18	23	41
	TOTAL DROPPED	21	25	46
III	ENTERED DURING THE MONTH	6	10	16
	ENTERED PREVIOUSLY	7	20	27
	TOTAL ENTERED	13	30	43
IV	ENROLLMENT TOTAL FOR YEAR			
	FRESHMEN	292	316	608
	SOPHOMORES	230	244	474
	JUNIORS	197	199	396¤
	SENIORS			
	OTHER			
	TOTAL	719	759	1,478
V	ENROLLMENT LAST DAY OF MONTH			
	FRESHMEN	288	305	593
	SOPHOMORES	227	241	468
	JUNIORS	183	188	371
	SENIORS			
	OTHER			
	TOTAL	698	734	1,432

NUMBER OF DAYS SCHOOL WAS IN SESSION	17
TOTAL DAYS STUDENTS IN ATTENDANCE	23,017.0
TOTAL DAYS STUDENTS WERE ABSENT	1,673.0

(Figure 21)

HOME ROOM	CLASS	GRADING PERIOD ENDING
A201	71	11/10/67

REPORT OF
REID DAVID B

TELEPHONE
537-5224

WM W REID
378 ROSEWOOD
BUFFALO GROVE IL 60090

WHEELING HIGH SCHOOL
TOWNSHIP HIGH SCHOOL DISTRICT 214
STUDENT PROGRESS REPORT

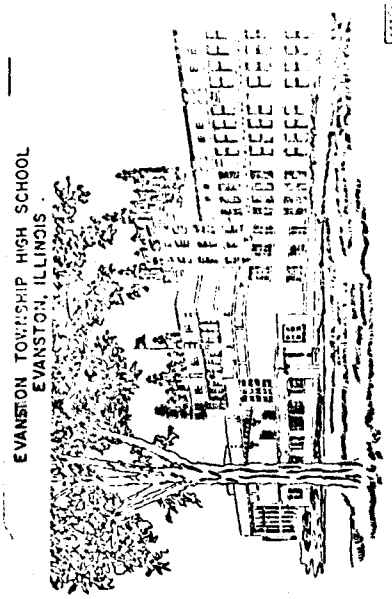
SUBJECT	TEACHER INITIALS	1ST SEM-GRADES 1 Q	2 Q	EXAM	SEM	2ND SEM-GRADES 3 Q	4 Q	EXAM	SEM	CLASSROOM CITIZENSHIP COOPERATION	INDUSTRY	INTELLECTUAL CURIOSITY
ENGLISH I	AHS	B	B	B	B					2	2	2
ALGEBRA I	EDS	A	A	B	A					1	1	1
BIOLOGY	CJM	B	C	B	B					2	2	2
SPANISH	RMC	C	B	C	C					2	3	3
PHYS EDUC	HJL	C	C		C					2	2	2
BAND	EJF	A	B		A					1	1	2

1 Q	2 Q	3 Q	4 Q
03	02		

ABSENCES
ABSENCES IN HALF DAYS (SEE REVERSE SIDE)

CLASSROOM CITIZENSHIP CODE
1 MEANS OUTSTANDING
2 MEANS SATISFACTORY
3 MEANS IMPROVEMENT NEEDED
COOPERATION: ABILITY TO WORK WITH CLASSMATES AND TEACHER.
INDUSTRY: EFFICIENT USE OF TIME IN CLASS.
INTELLECTUAL CURIOSITY: INITIATIVE AND ORIGINALITY

(Figure 22)



LIBRARY
BOOK CARD

EVANSTON TOWNSHIP
HIGH SCHOOL

AUTHOR | TITLE | ACCESSION NO. | DEWEY NO. | ALPHA

(Figure 23)

HALL COPY
LIBRARY COPY
STUDENT COPY

EVANSTON TOWNSHIP HIGH SCHOOL

LIBRARY MATERIALS OVERDUE

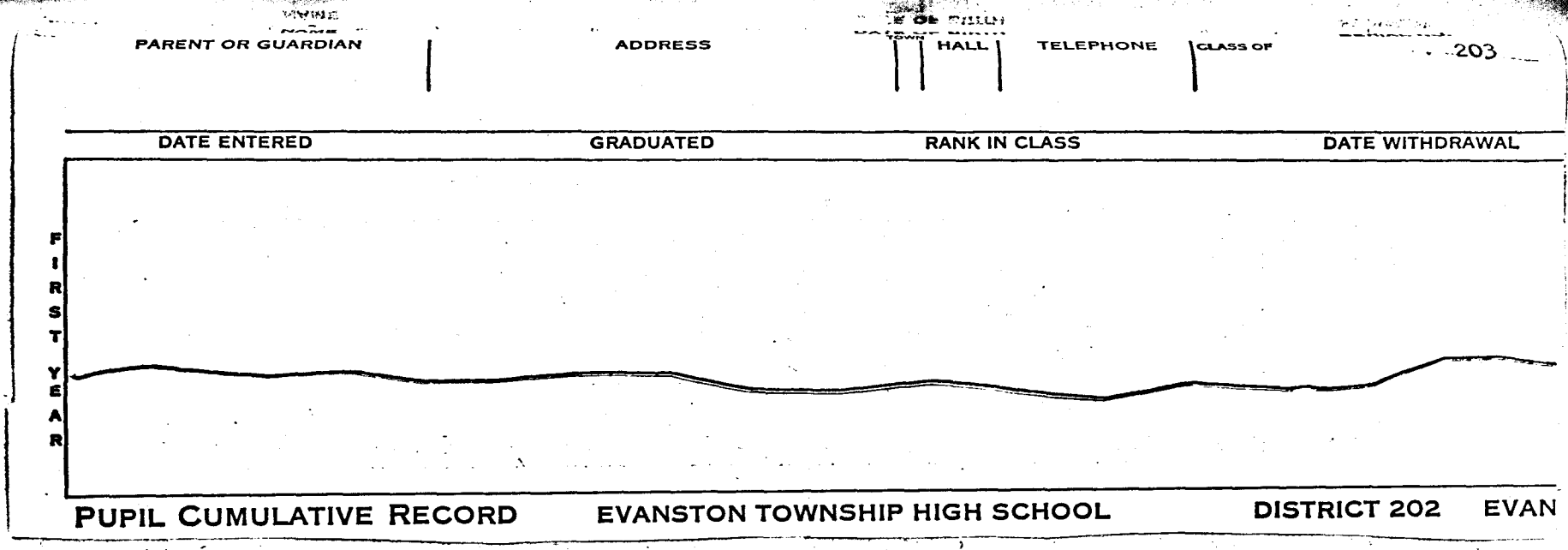
ID	STUDENT NAME	HALL - HR.	YEAR	DATE		DATE CLEAR

DATE DUE	CALL NUMBER	AUTHOR	TITLE	ACCESSION NUMBER	DATE RETURNED	SIGN

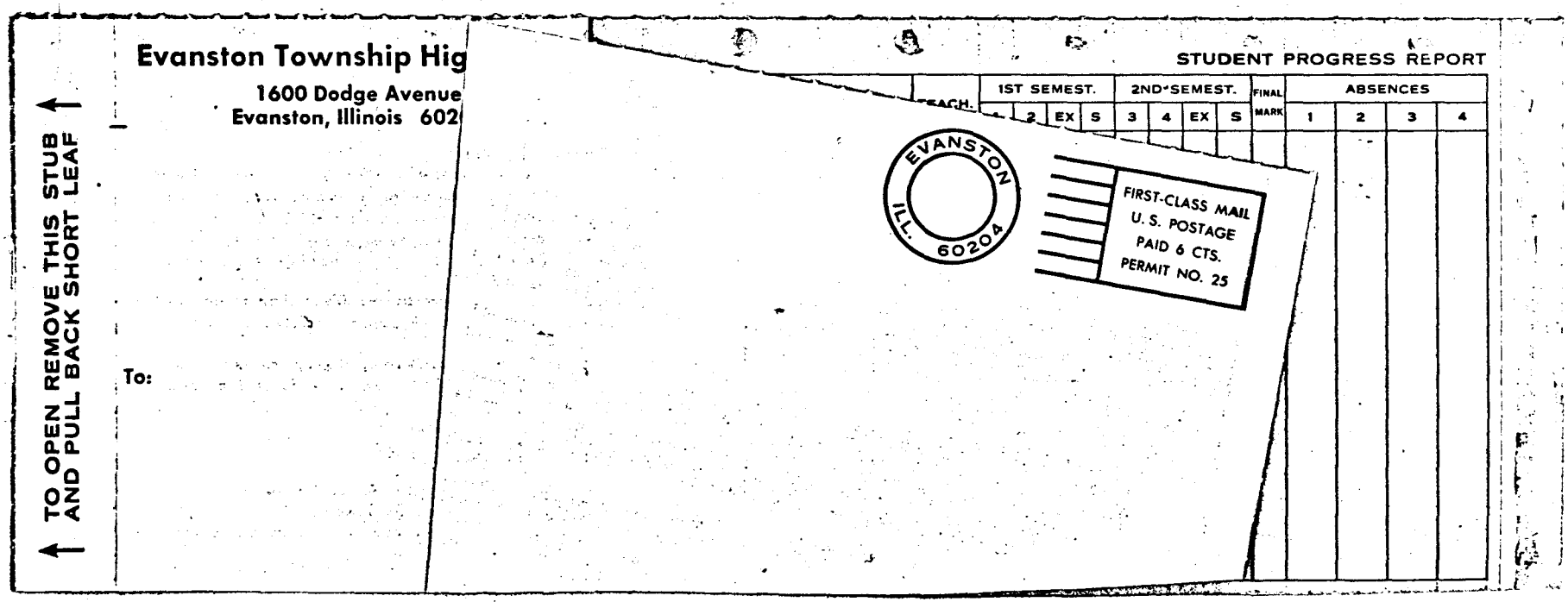
(Figure 24)

L YEAR		TEACHER	1ST SEMESTER				2ND SEMESTER				FINAL	CREDIT				ABSENCES BY QUARTER				SERIAL NO.
			1	2	SEM. EXAM.	SEM.	3	4	SEM. EXAM.	SEM.		¼	½	1		1	2	3	4	

(Figure 25)



(Figure 26)



(Figure 27)

BOYS ABSENT TUESDAY JAN 16 - A DAY PAGE 1

NAME	STU. NO.	CONSEC	CUM ABS
ANDREWS KENNETH	69B 02001		2.0
BENNETT THOMAS	69B 05684		9.0
BLAKE RICHARD	68B 07279	2	3.0
BOONE WILLIAM	68B 08178		5.0
BRANCATO DENNIS	68B 09135	2	13.5
BRANCATO GARY	68B 09164	2	6.0
BUTLER DAVID	69B 11948		6.0
CALMER CHARLES E	69B 12499		6.0
CARLSON DAN	69B 13108		22.5
CATTERSON ROBERT	69B 13920	2	4.0
		2	4.0

(Figure 28)

F GRADES - 1ST SEMESTER 66-67 PAGE 06

STU.NO.	YR	SEX	NAME	SUBJ NO.	TITLE	PER	TCHR	ROOM
24185	68	B	KRATZNER JAMES	455 08	ENGLISH III	4	AR	200
24185	68	B	KRATZNER JAMES	952 08	PHYS ED JR BOYS	6B	RS	188
24210	68	B	KRAUS JEFFREY	331 01	CHEMISTRY	1	EC	333
24873	68	B	LACEK RAYMOND V	059 01	ENGLISH SKILLS REV	3A	AM	129
25248	68	B	LANG WILLIAM	952 08	PHYS ED JR BOYS	5B	AS	188
25561	68	B	LEEMHUIS F	240 01	GERMAN I	5	MM	307
25561	68	B	LEEMHUIS F	150 13	INT ALGEBRA WA	3	AS	228

SAMPLE

(Figure 29)

LYONS TOWNSHIP HIGH SCHOOL DISTRICT 204 — **PROGRESS REPORT**

STUDENT NAME		YEAR	STUDENT NO.	ACADEMIC YEAR	UNITS OF CREDIT
ZAUSS BARBARA D	011	67	47006	1966-67	11.50 FORWARDED

ATTENDANCE RECORD → HALF-DAYS ABSENT: 1: 7, 2: 5, 3: , 4: | TIMES TARDY: 1: , 2: 2, 3: , 4:

SUBJECTS CODE		TITLE		ACADEMIC RECORD 1ST QUAR.	SEM. 1	3RD QUAR.	SEM. 2	EARNED THIS YEAR
620	81	FOODS-NUTRITION SS66			C		C-	1.00
058	01	STAGECRAFT	DT	B-	A-			
074	01	ENGLISH IV B	JMA	B	C+			
096	01	THEATRE II	DT	C	C+			
440	16	AMERICAN HISTORY LI	FF	F	D			
630	01	FOREIGN FOODS	BD	C	C			.50
958	08	PHYS ED SR GIRLS	JJ		C+			

SAMPLE

MR MRS LOUIS ZAUSS
4336 GRAND AVE
WESTERN SPRGS ILL 60558

GRADING SYSTEM

A -SUPERIOR
B -ABOVE AVERAGE
C -AVERAGE
D -BELOW AVERAGE
F -FAILURE
P -LOWEST PASS
U -CONDITION
X -INCOMPLETE
W-WITHDRAWN

(Figure 30)

LYONS TOWNSHIP HIGH SCHOOL
DISTRICT 204

TEACHER'S CLASSROOM LIST

HOME CONTACT CODES
R - REPORT SENT
T - PHONE CONVERSATION
C - PERSONAL CONFERENCE WITH PARENT

TEACHER	SUBJECT TITLE	PERIOD	CODE	TERM	ROOM
NJJ	ENGLISH III HONORS	6	034 02	A	130

(○) CLASS LIST (★) GRADE REPORT — ASTERISK (*) INDICATES THE PURPOSE OF THIS LIST

	STUDENT NAME	YEAR	SEX	STUDENT NUMBER	GRADES 1ST QUAR.	GRADES SEM. 1	GRADES 3RD QUAR.	GRADES SEM. 2	HOME CONTACT 1ST QUAR.	HOME CONTACT SEM. 1	HOME CONTACT 3RD QUAR.	HOME CONTACT SEM. 2	CREDIT OR RECOMMENDATION	CONFERENCE W/DEPT. CHMN.
1	BARCLAY ARLENE	69	G	03654	A-	A								
2	BICEK MARGARET	69	G	06525	A+	A+								
3	BUMP THOMAS	69	B	11020	A	A+								
4	CARHART BRUCE	69	B	12963	B+	A-								
5	CHEVAS CYNTHIA	69	G	14819	A	A								
6	DICKINSON HOLLY	69	G	20909	B+	B+								
7	DONCARLOS MICHAEL	69	B	21779	A-	A								
	[illegible] KAREN	69	G	24360	A-	A-								

(Figure 31)

STUDENT NO. 00249 | STUDENT NAME ALBERTS MICHAEL | ACADEMIC YEAR 66-67

SUBJECT	GRADES:	SEM 1	SEM 2	CREDIT
BIOLOGY	SS66	C	D	1.00
ENGLISH II R		C+	C	1.00
DEBATE A			C	.50
SPEECH ARTS		C		.50
GEOMETRY R		B	C+	1.00
SPANISH II		C+	C-	1.00
PERSONAL TYPING	L2	C		.50
BASIC MECH DR	L1		C	.50
Y SOPH BOYS PHYS ED		B	B	.25
Y DRIVER EDUCATION				.00

TOTAL CREDITS EARNED THIS YEAR: 6.25

1/2 DAYS-ABSENT	TIMES TARDY	GRADE POINT AVERAGE	%ILE	CLASS SIZE	CUMULATIVE CREDITS
0 0 0 0 0 0 2	0 0 0 0 0 0 0	2.090	52	1172	11.75

(Figure 32)

LTHS CLASS RANK REPORT -- BY RANK

SENIOR CLASS -- 1022 STUDENTS -- JUNE, 1967 PAGE 2

	STUDENT NAME AND NUMBER		RANK	%ILE	GPA	CREDITS
45768	WHITE HARLAN R	67 B	53	94	3.416	22.75
38510	SCHWEINBERG KATHRY	67 G	54	94	3.411	17.50
26165	LINNERT SHARON L	67 G	54	94	3.411	21.25
02982	BENZIES BARBARA M	67 G	56	94	3.403	20.75
33945	POREBSKI JAMES M	67 B	57	94	3.394	19.75
17118	HANSON MARGARET A	67 G	58	94	3.393	21.75
02645	BECK VERNON D	67 B	59	94	3.384	20.75
33[illegible]				94	3.379	19.25

(Figure 33)

LYONS TOWNSHIP HIGH SCHOOL - CLASS SCHEDULE

STUDENT NAME	STUDENT NO.	YEAR	SEX	SCHOOL YEAR
DAHMS DONALD JAMES	18763	70	B	1967-68

PARENT (GUARDIAN) NAME AND ADDRESS	PHONE	TERM CODES
MR & MRS DONALD DAHMS 826 N CATHERINE LAGRANGE PARK ILL 60525	354-4615 LOCKER NO. 1881	A - ANNUAL F - FALL ONLY S - SPRING ONLY COMM. ROOM 050

CODE	SUBJECT DESCRIPTION	TERM	PERIOD	ROOM	TEACHER	FEES
73201	WOODS	F	1	023	J L	3.00
00001	STUDY HALL	S	1	125	DGS	
31004	BIOLOGY	A	2	050	A N	2.00
00001	STUDY HALL	F	3	125	D M	
75103	METALS	S	3	024	DMB	
02412	ENGLISH II R L 1	A	4	128	BAG	
94409	X SOPH BOYS PHYS ED	A	5A	136	NHR	2.75
00001	STUDY HALL	A	5B	125	JFL	
12919	PLANE GEOMETRY R	A	6	227	SKV	
						7.75*

(Figure 34)

PERMIT TO REGISTER

NORTHEASTERN ILLINOIS STATE COLLEGE
BRYN MAWR AT ST. LOUIS AVE.
CHICAGO, ILLINOIS 60625

TELEPHONE JU 3-4050

PLEASE PRINT

SEMESTER 19

NAME

ADDRESS

CITY & STATE

ZIP CODE

☐ UNCONDITIONAL ADMISSION

☐ CONDITIONAL ADMISSION

UNDERGRADUATE

☐ FRESHMAN

☐ ADVANCED STANDING

[Q] ☐ UNCLASSIFIED

STUDENTS WITH DEGREES

[R] ☐ UNCLASSIFIED WITH BACHELORS

[Y] ☐ UNCLASSIFIED WITH MASTERS

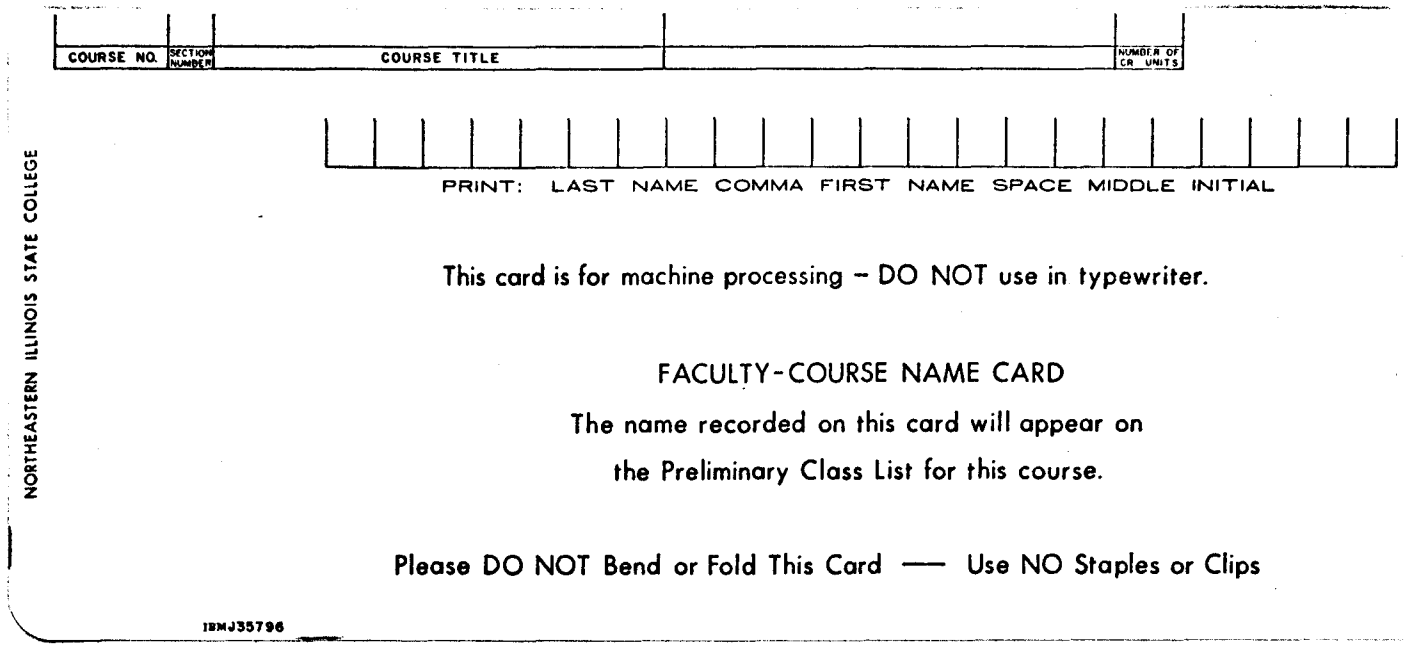
[Z] ☐ GRADUATE APPLICANT

ADMISSIONS OFFICE

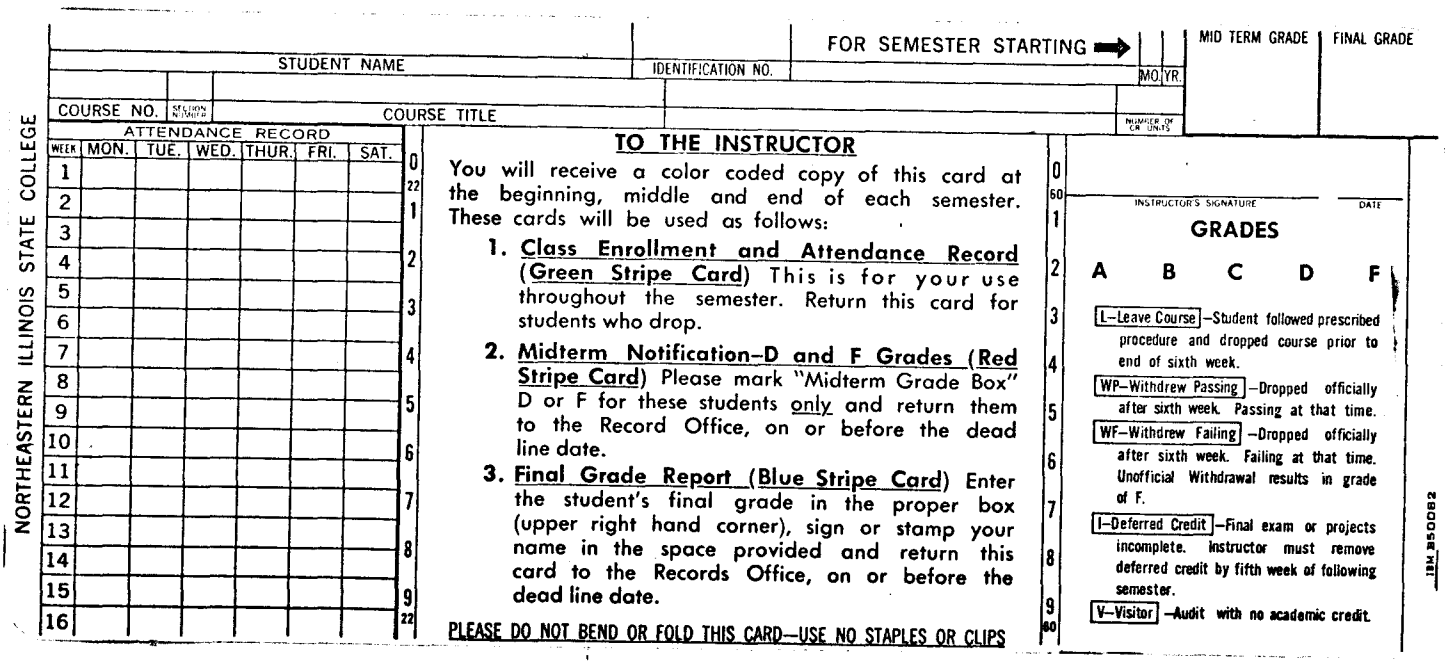
PERMIT TO REGISTER NOT VALID UNLESS STAMPED BY ADMISSIONS OFFICE

IBM J35283

(Figure 35)



(Figure 36)



(Figure 37)

NORTHEASTERN ILLINOIS STATE COLLEGE

CLASS LIST 208

SEMESTER	COURSE TITLE	COURSE NO.	SEC. NO.	INSTRUCTOR	CREDIT HRS.

LINE NO.	STUDENT I.D. NO.	NAME	GRADE
1			
2			
3			
22			
23			
24			
25			

INSTRUCTOR'S SIGNATURE

FINAL GRADES

INSTRUCTOR'S SIGNATURE

FINAL GRADES – INSTRUCTOR'S COPY

INSTRUCTOR'S SIGNATURE

MID-TERM GRADES – INSTRUCTOR'S COPY

INSTRUCTOR'S SIGNATURE

MID-TERM GRADES

(Figure 38)

STUDENT NAME

COURSE

WRITE EXAM NO. HERE

INSTRUCTOR NAME

SECTION NUMBER

DATE

PUNCH EXAM NUMBER HERE

36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
0	0	0	0																															
1	1	1	1	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
2	2	2	2	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
3	3	3	3	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
4	4	4	4	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
5	5	5	5	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
6	6	6	6																															
7	7	7	7																															
8	8	8	8																															
9	9	9	9																															

INSTRUCTIONS

1. CIRCLE ANSWERS DURING THE TEST.
2. TIME WILL BE ALLOWED FOR PUNCHING AT END OF THE EXAMINATION.
3. MORE THAN ONE PUNCH TO A QUESTION WILL INVALIDATE YOUR ENTIRE EXAMINATION.

"COMPUTER-GRADED" EXAM CARD NO. 2

(Figure 39)

CHICAGO STATE COLLEGE
ENROLLMENT ENVELOPE

IMPORTANT: ALL PREPRINTED INFORMATION COMES FROM YOUR ADMISSIONS OR LAST ENROLLMENT. REVIEW ALL INFORMATION AND MAKE ANY CORRECTIONS OR CHANGES IN THE ASSIGNED AREAS.

1. NAME — LAST FIRST MI (PRINT)
2. SOCIAL SECURITY NO. — — —
3. MARITAL STATUS ☐ 1. SINGLE ☐ 2. MARRIED

1-A CHANGE TO: LAST FIRST MI
2-A CHANGE TO: — —
3-A CHANGE TO: ☐ 1. SINGLE ☐ 2. MARRIED

4. ARE YOU A LEGAL RESIDENT OF ILLINOIS? ☐ 1. YES ☐ 2. NO
5. ARE YOU WORKING FOR A DEGREE AT C.S.C.? ☐ 1. YES ☐ 2. NO
6. IF YES, WHICH? ☐ 1. BS ED ☐ 2. MA ☐ 3. MS ☐ 4. MS ED

4-A CHANGE TO: ☐ 1. YES ☐ 2. NO
5-A CHANGE TO: ☐ 1. YES ☐ 2. NO
6-A CHANGE TO: ☐ 1. BS ED ☐ 2. MA ☐ 3. MS ☐ 4. MS ED

7. IF YOU ARE WORKING FOR A BACHELOR'S DEGREE AT C.S.C.
YOUR CURRICULUM IS: ☐ 1. KGP ☐ 2. INT. UG. ☐ 3. SEC. MAJ. ☐ 4. BUS. ED. ☐ 5. HOME ECON. ☐ 6. IND. ED.

7-A CHANGE TO: ☐ 1. KGP ☐ 2. INT. UG. ☐ 3. SEC. MAJ. ☐ 4. BUS. ED. ☐ 5. HOME ECON. ☐ 6. IND. ED.

8. VETERAN? ☐ YES ☐ NO
8-A CHANGE TO: ☐ YES ☐ NO

9. ON SCHOLARSHIP? ☐ YES ☐ NO
9-A CHANGE TO: ☐ YES ☐ NO

10. INTERMEDIATE AND UPPER GRADE OR KGP STUDENTS SHOULD CHECK GEN. ED. (4) AS THEIR SEQUENCE (HOME ECON. HAS NO SEQUENCE)

YOUR SEQUENCE IS:
☐ 1. ART ☐ 2. ENG. ☐ 3. GEO. ☐ 4. GEN. ED. ☐ 5. HIST. ☐ 6. MATH ☐ 7. MUS. ☐ 8. BIOL. SCI.
☐ 9. PHYS. ED. ☐ 10. ACCT. ☐ 11. BUS. TRNG. ☐ 12. STENOG. ☐ 13. H.S. DRAFT ☐ 14. H.S. SHOP ☐ 15. E.M.H. ☐ 16. PHY. SCI.

10-A CHANGE TO
☐ 1. ART ☐ 2. ENG. ☐ 3. GEO. ☐ 4. GEN. ED. ☐ 5. HIST. ☐ 6. MATH ☐ 7. MUS. ☐ 8. BIOL. SCI.
☐ 9. PHYS. ED. ☐ 10. ACCT. ☐ 11. BUS. TRNG. ☐ 12. STENOG. ☐ 13. H.S. DRAFT ☐ 14. H.S. SHOP ☐ 15. E.M.H. ☐ 16. PHY. SCI.

11. IF YOU HAVE BEEN ADMITTED TO THE C.S.C. GRADUATE SCHOOL YOUR PROGRAM OF STUDY IS:
☐ 1- SCHL. LIB. ☐ 2- IND. ED. ☐ 3- MENT. HAND. ☐ 4- SCHL. GUID. ☐ 5- ENG. ☐ 6- MATH ☐ 7- SCIENCE ☐ 8- HISTORY ☐ 9- GEOGRAPHY ☐ OTHER

11-A CHANGE TO:
☐ 1- SCHL. LIB. ☐ 2- IND. ED. ☐ 3- MENT. HAND. ☐ 4- SCHL. GUID. ☐ 5- ENG. ☐ 6- MATH ☐ 7- SCIENCE ☐ 8- HISTORY ☐ 9- GEOGRAPHY ☐ OTHER

12- YOUR C.S.C. ACADEMIC CLASSIFICATION IS: (NOTE: AN UNCLASSIFIED STUDENT IS ONE WHO HAS A BACHELOR'S DEGREE AND HAS NOT BEEN FORMALLY ADMITTED TO GRAD. SCHOOL)
☐ 1- FRESHMAN 0-32 CR. HRS. ☐ 2- SOPHOMORE 33-64 CR. HRS. ☐ 3- JUNIOR 65-96 CR. HRS. ☐ 4- SENIOR 97 CR. HRS. ☐ 5- SPECIAL UNDERGRAD. ☐ 6- UNCLASSIFIED ☐ 7- FORMALLY ADMITTED TO GRAD. SCHOOL ☐ 8- MASTERS DEGREE

12-A CHANGE TO:
☐ 1- FRESHMAN 0-32 CR. HRS. ☐ 2- SOPHOMORE 33-64 CR. HRS. ☐ 3- JUNIOR 65-96 CR. HRS. ☐ 4- SENIOR 97 CR. HRS. ☐ 5- SPECIAL UNDERGRAD. ☐ 6- UNCLASSIFIED ☐ 7- FORMALLY ADMITTED TO GRAD. SCHOOL ☐ 8- MASTERS DEGREE

13- FOR HOW MANY CREDIT HOURS ARE YOU NOW REGISTERING THIS TERM AT C.S.C., INCLUDING DAY, EVENING AND EXTENSION COURSES?
NOTE: PSYCH. 115 COUNTS AS ONE CREDIT HOUR; ENG. 98 AS TWO CREDIT HOURS.
TOTAL

I HAVE CHECKED THE ☐ ENROLLMENT ENVELOPE ☐ REGISTRATION CARDS _____ INITIALS

(Figure 40)

DEPT.	COURSE NO.	SEC	COURSE TITLE	CR HRS	INSTRUCTOR	SEMESTER STARTING →	MO.	YR.	SEQ. NO.
TIME	DAYS	ROOM ##		ADD TIME	ADD DAYS	ADD ROOM			

CHICAGO STATE COLLEGE D-567

REGISTRATION CARD

DO NOT WRITE ON THIS CARD

TO THE STUDENT

CHECK TO SEE THAT THIS CARD IS FOR THE CLASS YOU WANT. PUT ONE REGISTRATION CARD FOR EACH CLASS ON YOUR WORK SHEET IN YOUR REGISTRATION ENVELOPE AND TURN IN THE ENVELOPE BEFORE PAYING FEES.

YOU WILL BE REGISTERED ONLY IN COURSES FOR WHICH YOU HAVE REGISTRATION CARDS.

PRINTED IN U.S.A. UNIVAC P-154424-R

(Figure 41)

CHICAGO STATE COLLEGE

ACTIVITIES OFFICE

CLASS SCHEDULE

NAME (LAST / FIRST / M.I.)	SOCIAL SECURITY NO.	DATE OF BIRTH (MO. / DAY / YR.)	LOCKER NO.	TELEPHONE NO.

ADDRESS	IN CASE OF ACCIDENT NOTIFY	TELEPHONE NO.	VETERAN	ON SCHOLARSHI
			☐ YES ☐ NO	☐ YES ☐ N

CURRICULUM

☐ 1 - KGP ☐ 2 - INT. UG ☐ 3 - SEC. MAJ. ☐ 4 - BUS. EDUC. ☐ 5 - HOME ECON. ☐ 6 - IND. ED. ☐ 7 - SPECIAL ☐ 8 - UNCLASS

DEPARTMENT	COURSE NUMBER	SECTION	HOUR OF CLASS SESSIONS						ROOM	DATE
			MON.	TUES.	WED.	THURS.	FRI.	SAT.		

(Figure 42)

DEPT. | COURSE NO. | SEC | COURSE TITLE | CR HRS | INSTRUCTOR | SEMESTER STARTING → | MO | YR | GRADE

SOCIAL SECURITY NO. — — | STUDENT NAME | CLASS

CHICAGO STATE COLLEGE D567

ATTENDANCE RECORD

WEEK	MON	TUES	WED	THURS	FRI	SAT
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

CLASS CARD

TO THE INSTRUCTOR

YOU WILL RECEIVE A COLOR-CODED COPY OF THIS CARD AT THE BEGINNING AND END OF EACH SEMESTER. THE CARDS WILL BE USED AS FOLLOWS:

1. GREEN STRIPE
   CLASS ENROLLMENT AND ATTENDANCE CARD. THIS IS FOR YOUR USE THROUGHOUT THE SEMESTER.
2. RED STRIPE
   FINAL GRADE CARD. CIRCLE THE STUDENT'S FINAL GRADE, SIGN OR STAMP YOUR NAME ON THE DESIGNATED LINE, AND RETURN TO THE REGISTRAR'S OFFICE ON OR BEFORE THE DEADLINE DATE.
3. USE THE GREEN STRIPE CARD TO NOTIFY STUDENTS OF D OR F MIDTERM GRADES. CHECK THE APPROPRIATE GRADE AND SEND THE CARD TO THE REGISTRAR'S OFFICE. WHEN WARNING NOTICES HAVE BEEN SENT TO THE STUDENT THE CARD WILL BE RETURNED TO YOU.

CIRCLE GRADE EARNED

A B C D F

W (WITHDREW / /)

I (DEFERRED CREDIT)

V (AUDIT — NO CREDIT)

PRINTED IN U.S.A. UNIVAC P-164425

INSTRUCTOR'S SIGNATURE _____ DATE / /

(Figure 43)

DEPT. | COURSE NO. | SEC | COURSE TITLE | CR HRS | INSTRUCTOR | SEMESTER STARTING → | MO | YR | GRADE

SOCIAL SECURITY NO. — — | STUDENT NAME | CLASS

CHICAGO STATE COLLEGE D567

ATTENDANCE RECORD

WEEK	MON	TUES	WED	THURS	FRI	SAT
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

GRADE CARD

TO THE INSTRUCTOR

YOU WILL RECEIVE A COLOR-CODED COPY OF THIS CARD AT THE BEGINNING AND END OF EACH SEMESTER. THE CARDS WILL BE USED AS FOLLOWS:

1. GREEN STRIPE
   CLASS ENROLLMENT AND ATTENDANCE CARD. THIS IS FOR YOUR USE THROUGHOUT THE SEMESTER.
2. RED STRIPE
   FINAL GRADE CARD. CIRCLE THE STUDENT'S FINAL GRADE, SIGN OR STAMP YOUR NAME ON THE DESIGNATED LINE, AND RETURN TO THE REGISTRAR'S OFFICE ON OR BEFORE THE DEADLINE DATE.
3. USE THE GREEN STRIPE CARD TO NOTIFY STUDENTS OF D OR F MIDTERM GRADES. CHECK THE APPROPRIATE GRADE AND SEND THE CARD TO THE REGISTRAR'S OFFICE. WHEN WARNING NOTICES HAVE BEEN SENT TO THE STUDENT THE CARD WILL BE RETURNED TO YOU.

CIRCLE GRADE EARNED

A B C D F

W (WITHDREW / /)

I (DEFERRED CREDIT)

V (AUDIT — NO CREDIT)

PRINTED IN U.S.A. UNIVAC P-154426

INSTRUCTOR'S SIGNATURE _____ DATE / /

(Figure 44)

APPROVAL SHEET

The dissertation submitted by Herbert Irwin Greenwald has been read and approved by members of the Department of Education.

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that the dissertation is now given final approval with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirement for the degree of Doctor of Education.

June 12, 1969
Date

James H. Smith
Signature of Advisor